




THE LIBRARY
OF
THE UNIVERSITY
OF CALIFORNIA
DAVIS



Digitized by the Internet Archive
in 2012 with funding from
University of California, Davis Libraries



CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

FLETCHER HAMILTON

State Mineralogist

Vol. 19

JANUARY, 1923

No. 1

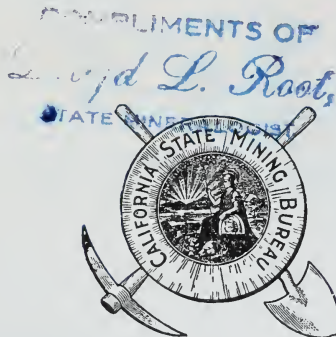
MONTHLY CHAPTER OF
REPORT XIX OF THE STATE
MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE
FRANK J. SMITH, Superintendent
SACRAMENTO, 1923

2---24963

LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS

CONTENTS.

	Page
PREFACE -----	4
DISTRICT REPORTS OF MINING ENGINEERS -----	7
Redding Field Division -----	7
Auburn Field Division -----	13
San Francisco Field Division -----	21
Los Angeles Field Division -----	29
Oil Field Development Operations -----	33
SPECIAL ARTICLES -----	38
Primary and Secondary Gold Concentrations -----	38
SECRETARY'S OFFICE -----	41
DEPARTMENT OF MINERALS AND STATISTICS -----	43
Statistics -----	43
Estimate of 1922 Output -----	43
Museum -----	44
Laboratory -----	45
LIBRARY -----	46
PRODUCERS AND CONSUMERS -----	51
Mineral Products or Deposits For Sale -----	51
Mineral Products or Deposits Wanted -----	51
EMPLOYMENT SERVICE -----	52
BUREAU PUBLICATIONS -----	53

OUTLINE MAP OF CALIFORNIA

SCALE



O R E G O N

M E X I C O

• LEGEND •

— Mining Division Boundaries.

● Mining Division Offices.

PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive forward step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922.

A monthly publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff are included. Mineral production reports formerly issued as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance are reported monthly. The assistance formerly given to producers and consumers by consultation or correspondence only, is also proffered through this medium.

While current activities of all descriptions will be reported in this Monthly Chapter, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added to that list in the future as they are completed.

The Monthly Chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

Beginning with the January issue the pages are numbered consecutively throughout the year, and an index to the complete reports will be included annually in the December number.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful latent resources of the State of California.

'Mining in California' is sent without charge to those on the Bureau's exchange list and to all others who make written or verbal request.

TO THE MINING PUBLIC.

Through ten years of service as State Mineralogist and executive head of the State Mining Bureau, I have endeavored to build up an institution that would be representative of the mining and oil industry of California, in order to create an organization of service to the industry and to the public at large which would aid in the development of the wonderful mineral resources of the State of California.

Work of this character can be accomplished only by the united effort and cooperation of those serving and the industry to be served. It is with some degree of satisfaction that I look back upon this period and note the marveling growth of the industry and the ability of this Bureau to grow and meet the ever-increasing demands made upon it. This growth has been made possible by the sympathetic cooperation and expression of the prospectors, engineers and owners of properties from all localities in the state, and it is my hope that in the years to come the Bureau's service to the public may increase many fold; I sincerely believe that it has a very important influence on the development of our latent resources.

There comes a time when it is impossible to continue public service without a sacrifice which is greater than personal interests can withstand, and it has become necessary to submit my resignation, which is given herewith.

SAN FRANCISCO, January 27, 1923.

HON. FRIEND WM. RICHARDSON,
Governor of California,
Sacramento, California.

DEAR SIR: I herewith submit my resignation as State Mineralogist of California, to be effective February fifteenth, nineteen hundred and twenty-three.

It is with a certain regret that I terminate my direction of the activities of the State Mining Bureau. I have realized for some time, however, that a continuance in public service was at a sacrifice to my personal interests.

During my administration of ten years, I have recorded the growth of California's mineral production from an annual value of ninety-three million dollars to the astonishing total of two hundred and sixty-eight million dollars, and have endeavored so to organize the State Mining Bureau that its service to the industry and the public would respond to this constantly growing production and the consequent demands because of it, in order that the greatest degree of aid to the development of our latent mineral resources might be attained.

Mining is the basic industry upon which our industrial, and even our agricultural, advancement depends. The proper development of our vast mineral resources, wise encouragement and their sane conservation are surely problems second to none in importance in the upbuilding of our great commonwealth.

We all know of the stupendous development of our oil resources in recent years, in the proper development and production of which the State Mining Bureau has taken no little part, but scant knowledge is had of the fact that a resource of close to two billions of dollars lies dormant in the unworked gravel deposits of California. A report is now well under way which, it is hoped, will focus the attention of the State upon the possibilities of winning this wealth and at the same time aid in the solution of our reclamation, irrigation, power and navigation problems, with which we are all so familiar.

The Great Mother Lode Gold Belt of California, which has produced millions and which will produce many more, is also the subject of another report, now in course of preparation.

California produces, in addition to these two vital resources, over fifty different commercial metal and mineral products, all of which are adding to the wealth and prosperity of the State.

It has been my good fortune to have met and known personally a great many men, connected with the mineral industry, and I am appreciative of the cooperation they have given in the work of the Bureau. A number of the employees have been in the

department for many years, and I take this opportunity of expressing my acknowledgment of their loyal service.

My paramount aim has been to build a tradition of service which would bring to California a recognition of her vast mineral treasure and I trust that the greatest possible support will always be given by the State to this great industry.

Assuring you of my continued interest in the work of the Bureau and the development of the mineral resources of California, I remain,

Respectfully yours,

FLETCHER HAMILTON,
State Mineralogist of California.

It is with regret that I submit this farewell to the State Mining Bureau, as through it I have formed many pleasant associations; and I send greetings to all in the mining industry, assuring you that I shall always have your best interests at heart.

FLETCHER HAMILTON.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each division working out from a local branch office.

This move brought the Bureau into close personal contact with operators, but did not materially shorten the time between the gathering of data in the field and their publication in the Report of the State Mineralogist at the end of an annual or biennial period.

Mining activities and development noted by district engineers in their respective fields are now embodied in monthly reports published in each issue of 'Mining in California,' thus making these data available within a maximum period of thirty days, and the Monthly Chapter as far as possible a compendium of current mining progress throughout the state.

The counties included in each field division and the location of the local offices are shown on the accompanying outline map of the state. (Frontispiece.)

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

REDDING FIELD DIVISION.

W. BURLING TUCKER, Mining Engineer.

REVIEW OF MINING DURING 1922.

The principal minerals mined in this district are copper, gold, iron, platinum, silver, zinc and pyrites. Asbestos, cadmium, chrome, clay, coal, diatomaceous earth, limestone, manganese, mineral water, quicksilver, volcanic ash, and pumice have all been produced to a lesser extent, but the industry is dependent mainly upon the first group, each mineral of which is considered separately.

ASBESTOS.

An increased demand for asbestos on the Pacific Coast has led to the discovery and development of promising deposits of this mineral in Shasta County near Sims, Siskiyou County near Edgewood, and in Trinity County in the vicinity of the Strode mine, near Carrville. In the above mentioned localities both amphibole and chrysotile have been developed and during the coming year some of these deposits may be established on a producing basis.

BARYTES.

During the year the barite deposit at Barium, near Copper City, Shasta County, was operated by H. C. Austin and a large tonnage of ore was shipped to Oakland and San Francisco.

CHROMITE.

Chromite is widely distributed throughout Del Norte, Shasta, and Siskiyou counties. There were no producers during the year, owing to

importations of foreign ore which can be landed at consuming centers cheaper.

COAL.

Deposits of coal occur in Humboldt, Shasta, Siskiyou, and Trinity counties, but the majority of these deposits are low grade lignites, usually occurring in rather thin beds. Coal is found in Humboldt County near Gerberville, near Hydesville, on Mad River, and on Maple Creek. In Shasta County beds of lignite coal are found on Cow Creek, in the Ingot district, also on Clover Creek. A vein of semi-bituminous coal is found on Beegum Creek. Deposits of coal occur in Siskiyou County at the headwaters of Kosh Creek, seven miles southeast of Glazier, on the Sisson and Fall River Mills road, also on Willow Creek, about four miles east of Henley. Coal is found in Trinity County in Hayfork Valley, Hyampom Valley, and near Poison Camp.

During the year only a small amount of development work has been attempted on the various deposits mentioned. The coal is used locally for blacksmithing.

COPPER.

There has been little change in the copper situation during the year and practically all the large copper properties with the exception of the Mountain Copper Company, and the Shasta Zinc and Copper Company, remained idle. The former shipped about 500 tons per day of pyrite ore, containing a small percentage of copper, to chemical plants near San Francisco. Their aerial tramway extending from the Hornet mine to Mathewson, a station on the Southern Pacific Railroad, was completed and placed in commission. It is $2\frac{1}{2}$ miles in length, has a capacity of 100 tons per hour, and replaces the Iron Mountain Railroad, used by the company for ore shipments for many years.

The Shasta Zinc and Copper Company completed their new refining plant early in June. The Rising Star mine was operated from June 1st until December 1st furnishing ore for the zinc-oxide plant, but on the latter date both mine and smelter were shut down. It is reported that the company plans to increase the capacity of the present plant, and resume operations early in the spring. The company produced about 12 to 15 tons of copper matte per day, as a by-product from their zinc-oxide plant.

At the Little Nellie mine, owned by the Pittsburg and Mount Shasta Mining Company of Pittsburg, Pennsylvania, a number of men have been employed on development work. The producing mines of Shasta County during previous years were:

The United States Smelting, Refining and Mining Company (Mammoth smelter, and Mammoth, Keystone and Sutro mines); First National Copper Company (Balaklala mines); Mountain Copper Company, Limited (Iron Mountain and Hornet mines); Pittsburg and Mount Shasta Mining Company (Little Nellie mine); and the Atascadero Mining Company (Greenhorn mine), all on the West copper belt. On the East copper belt they were: The Shasta Zinc and Copper Company (Bully Hill and Rising Star mines); and the Afterthought Mining Company (Afterthought, Donkey and Copper Hill mines), at Ingot. In Siskiyou County there was no activity in copper mining during the year, and the Blue Ledge and Grey Eagle, the two most important mines in the county, remained idle.

GOLD.

The high cost of labor and material during the year has curtailed and depressed gold mining. Many mines both large and small have remained closed down, and the few properties that resumed operations during the early part of the year were finally forced to suspend operations.

The substantial increase in wages in the copper, steel and other fundamental industries recently has resulted in a general increase in the wage level and the gold producer is now confronted by still further increase in production costs. In the present condition of the industry, this increased cost can not fail to result in further shutting down of mines, with a consequent wastage of ore reserves, and the rapid deterioration of plants and equipment. The federal government should no longer deny the gold mining industry a necessary adjustment to compensate for the present increased cost of production, but, as a matter of equity and wise public policy, should, without further delay make suitable provision therefor.

GOLD DREDGING.

The only class of gold mining in this district that has materially increased is hydraulic and dredging activity.

The only placers of any importance in Shasta County are those worked by the four dredges. The Shasta Dredging Company operates one boat on the middle fork of Cottonwood Creek, near Gas Point. The American Gold Dredging Company, near Redding, resumed operations the first of January, after a long shut down. The two dredges owned by Louis Gardella of Oroville, operating on Clear Creek, about seven miles southwest of Redding, worked the entire year.

There is renewed activity in dredging in Trinity County on the Trinity River from Lewiston north to Trinity Center.

The Lewiston Gold Dredging Company purchased the Valdor dredge and removed it from Junction City to the Martin ranch, seven miles north of Lewiston, on the Trinity River. The dredge has been rebuilt and heavier equipment installed. It started operations the first of January, 1923.

The Gardella dredge, owned by Louis Gardella of Oroville, was placed in operation on October 1922, on the Paulson ranch, $1\frac{1}{2}$ miles southwest of Lewiston. This dredge is operating upon a gravel bar at a bend in the Trinity River opposite Rush Creek.

The Trinity Gold Dredging Company's dredge located four miles north of Lewiston, operated continuously during the year. Estabrook Gold Dredging Company resumed operations on November 26th after a long shutdown. The dredge is located north of Trinity Center.

The Pacific Gold Dredging Company, who were operating a steel dredge near Carrville, suspended operations early in May, and the dredge is being dismantled, preparatory to shipping it to the Federated Malay States for use in tin dredging.

The Shasta Dredging Company is reported to have acquired the Van Matre ranch near Minersville and will install a dredge on this ground during 1923. There is a possibility that during the coming year, there will be five dredges operating on the Trinity River.

HYDRAULIC MINING.

Hydraulic mining was active in Siskiyou and Trinity counties during the early part of the year. In Siskiyou County hydraulic mining was active near Cecilville, Oak Bar, Forks of the Salmon River, Sawyer's Bar, Scott's Bar and Fort Jones. There promises to be renewed activity in this class of mining during 1923, as a large number of placer mines have installed new equipment to take advantage of winter rains.

The producing placers in the county were: The Black Bear hydraulic mine at Black Bear Creek; small placers at Callahan; Banner and Jefferson Consolidated hydraulic, and Shadows Creek hydraulic near Cecilville; Nugget Bar, Conszetti, Oak Bottom Placer Syndicate, and Victory hydraulic, at Forks of the Salmon and Etna Mills; small hydraulic and ground sluicing at Fort Jones; Sulphur Springs hydraulic on Empire Creek at Gottville; Jahdi hydraulic on the Klamath River at Humbug; Davis Consolidated hydraulic mines, Huey Hill hydraulic and smaller mines at Happy Camp and Hornbrook; Robinson hydraulic mine at Oak Bar; Burns, Casey, Gold Bank, Lanky Bob, Paddy Cronin and the Hickey Homestead hydraulic mines at Sawyer's Bar; Quartz Hill hydraulic mine at Scott's Bar; Portuguese Bar drift at Seiad Valley; Blue Nose and Lange Bros. hydraulic mines at Walker; Big Joe, Wetzel, and other hydraulic and sluicing mines in the vicinity of Yreka. The water season for hydraulic and other gravel mines in this county lasted generally from three to four months.

In Trinity County the active hydraulic mines were: Lorenz Bros. hydraulic mine at Weaverville; The American-Italian Hydraulic Mining Company on Paulson ranch near Lewiston; Snow Gulch hydraulic and smaller mines at Carrville; Underground Treasure (ground sluicing) at Coffee; McAtee Bar on New River; Little Klondike group of hydraulic mines on South Fork of Trinity River, near Forest Glen; a few small hydraulic mines at Hawkins Bar; Eagle and Rattlesnake hydraulic mines at Helena; Red Hill and Jacobs hydraulic mines near Junction City; La Grange hydraulic mine, between Weaverville and Junction City.

The Unity hydraulic mine, four miles north of Minersville, was purchased by the Nugget Bar Placers Company of Oakland and during the latter part of the year a new dam, ditch line, and flume were installed preparatory to starting hydraulic operations the first part of the coming year.

The Pittsburg-Comstock Company of Virginia City, Nevada, acquired the Dannenbrink hydraulic mine, situated on Canyon Creek between Junction City and Dedrick, and planned to start mining operations in January, 1923. The season's run for hydraulic mines in Trinity County is from three to four months.

QUARTZ MINING.

Some activity was shown in quartz mining in Lassen and Modoc counties during 1922. In Lassen County there was increased activity in the Hayden Hill district with the Buckskin and Juniper mines under operation.

In Modoc County development work was in progress on the Big Four and Sunshine mines in the High Grade mining district.

Shasta County.

The only gold mines operating continuously throughout the year were the Milkmaid, Franklin and Sybel mines.

The former ran its 10-stamp mill on dump material. The 5-stamp mill of the Shasta Hills Mining Company was operated continuously on ore from the Sybel mine. Other properties that were small producers or were being developed were: El Dorado, Double Header, Gladstone, Summit and Washington mines in the French Gulch mining district; Reid and Texas Consolidated at Old Diggins; Gold Leaf, Yankee John, Boswell near Redding; West End, Mad Mule and Ganim near Whiskeytown; Independence and Ruby Pearl mines west of Castella. Considerable gold was brought into Redding from different pocket mines located in the Shasta, Whiskeytown and French Gulch mining districts.

Siskiyou County.

There was increased activity in quartz mining in Siskiyou County during the year, and the outlook for this class of mining looks encouraging for the year 1923. The following mines were under active operation: Cub Bear and Homestake mines near Etna Mills; Highland mine near Callahan; Keynote, Hoboken, and Mount Vernon mines near Yreka; Lone Pine, Ida May, Ben Bull mines near Cecilville; Mountain Laurel and Gold Ball mines near Sawyer's Bar; Spring Flag and Eliza mines near Humbug; Gilta mine on No-Nothing Creek; June Bride mine on Trail Creek; Hoboken mine at Fort Jones.

Trinity County.

There was very little activity in quartz mining in Trinity County during 1922 and practically all the work was confined to development.

Properties under operation were:

Lost Horse mine on Scorpion Creek in Coffee district, near Carrville, and the Packer mine near Coffee. Lessees took out ore from the Brown Bear mine at Deadwood. The Strode mine, north of Carrville, was under active development during the year. Layman mine, near Hayfork, was under operation during early part of year, but suspended operations in June. Enterprise mine operated until July when work was suspended; the 10-stamp mill ran part of the time. The Bonanza mine was under development. It is situated in the East Fork mining district near Helena. Trinity Bonanza King mine, north of Trinity Center, was operated by the Foster Gold Mining Company. Gold Leaf mine between Trinity Center and Delta. The Five Pines mine, in the Minersville district two miles north of Minersville, was operated by lessees. Gifford and Venicia mines on Eastman Gulch five miles north-east of Lewiston, were under active development during the year.

INFUSORIAL AND DIATOMACEOUS EARTH.

The Mount Shasta Silica Company of Weed, Siskiyou County, has been incorporated to develop and mine a large deposit of diatomaceous earth. The deposit is located in the northeastern part of Shasta County, close to the line of the Pacific Gas and Electric Company's railroad from Bartle to Pit River.

The holdings of the company are known as the Insulator group, consisting of 39 claims, located in T. 37 N., R. 2 and 3 E., about 20 miles from Bartle. The company plans to start operations in 1923.

IRON ORE.

The Noble Electric Steel Company, Heroult, Shasta County, continued to supply high grade magnetite, carrying 65 to 70 per cent iron, to San Francisco Bay points and Los Angeles during 1922. The shipments have averaged about 10 cars per month, during the year.

LEAD.

The production of lead for 1922 will probably be very small. A few lots of silver-lead ore were shipped from the White Star and Climax mines, South Fork mining district, near Igo, Shasta County, to the Selby Smelting and Lead Company, during the year.

LIMESTONE.

The only production of limestone was from the quarry on the Shasta Iron Company's property, shipped by the Noble Electric Steel Company to the Shasta Zinc and Copper Company at Winthrop for use as flux in the smelting plant.

MANGANESE.

Manganese mining has been stagnant throughout the entire state during the past year. There was no production of manganese from the northern counties during the year.

MINERAL WATER.

The principal production of mineral water in this district comes from Siskiyou County.

PETROLEUM.

The Tuscan Oil Company resumed drilling operations on its property six miles north of Red Bluff. The well is down 1800 feet and is in sand and blue shale.

PLATINUM.

Dredges operating in Shasta and Trinity counties produced practically all the crude platinum reported in 1922. A large part of the Shasta and Trinity crude platinum is osmiridium, recovered by the dredges on Trinity River, and Beegum and Hayfork Creek placers. A large number of claims were located on Hayfork and Beegum Creeks during the year, but the production was small from these placers, probably not amounting to over 10 ounces.

PYRITE.

The Mountain Copper Company, Shasta County, was the only producer of pyrite ore during the year. The ore mined and shipped from the Hornet mine averaged 45% sulphur and .7% copper. The ore is sold to the General Chemical Company and the Standard Oil Company. The latter company returns the pyritic cinder to the Mountain Copper Company's Martinez plant where it is leached and the copper recovered.

QUICKSILVER.

There was no activity in quicksilver mining in Modoc and Siskiyou counties due to the low price of the metal.

SILVER.

The California Bi-Metallic Corporation of Santa Barbara, California, which was organized in August, 1922, took over the Chicago and Silver Falls mine in the South Fork mining district, near Igo, Shasta County. An air compressor and other machinery were installed and additional camp accommodations have been provided. An active development campaign is under way and some high grade ore has been developed. Sixteen men are employed.

Other active mines in the district are the Continental, White Star, and Climax. Shipments of ore were made from the White Star and Climax mines during the year to the Selby Smelting and Lead Company. The prospect for continued activity in the silver mines of this district is bright.

ZINC.

The Shasta Zinc and Copper Company at Winthrop, on the east copper belt, was the only company mining zinc ores in 1922. The ore was mined from the Rising Star mine of the Bully Hill group. The 150-ton reverberatory smelter and zinc-oxide plant was completed in June, 1922, and operated until December, 1922, when operations were suspended due to a fall in price of zinc-oxide.

At this plant the crude ore is crushed to 10-mesh, and the sulphur content is reduced by roasting to make it suitable for reverberatory smelting. The copper, gold and silver are recovered in the matte and this matte is shipped to the Tacoma smelter. The fumes from the reverberatory pass to the first bag house, where the zinc-oxide is recovered. This zinc-oxide, which contains soluble sulphates, is retreated in a refining furnace and then passes to a second bag house where the zinc-oxide is recovered as a marketable product.

It is planned to increase the capacity of the plant and a resumption of operations is contemplated about April, 1923.

The Afterthought Mining Company at Ingot, Shasta County, California, was idle during the year.

AUBURN FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

II. CONDITION OF MINING IN THE AUBURN DISTRICT, 1922.

(Continued from December Chapter.)

Amador County.

This county remains the principal quartz gold producer on the Mother Lode and in this class of mining is next in point of production to Nevada County, with the probability that in 1923 it will considerably surpass the latter. The total gold yield for 1922 was about \$2,000,000. There have been numerous interruptions during 1922 in the operation of the principal mines, among which have been the Argonaut fire and the cessation of milling at the Central Eureka during extensive improvements.

When last visited (January 6), the work of retimbering and clearing the shaft at the *Argonaut Mine* had not been finished and foreman Ben Sanguinetti estimated that 50 feet remained blocked. The section of the shaft from 3350 feet to 2500 feet was the scene of the fire. Many

small caves occurred in this distance, most of them extending about 8 feet back into the wall. The largest cave was 50 feet long, 10 feet wide and 8 feet deep. The shaft was found to be completely filled from the 3100 level to 3350 feet, with rails, pipe, burnt timbers and caved ground, according to Sanguinetti, and allowed only slow progress. It was also filled at intervals above that. After the shaft is cleared, the water, which at this time is 7 sets below the 4500 level, will have to be removed. If no other delays arise meanwhile it will be April or May before milling is resumed.

The Argonaut disaster occurred on August 27 and it would appear that the fire had been burning only a short time when discovered at about 11.30 o'clock that night. As the later developments proved, the fight for the lives of the men underground was lost during the first hour or two after the fire started, if indeed they ever had a chance. The deplorable event attracted the attention of mining men all over the country and many hurried and ill-advised statements were made and given wide circulation. There will probably always be a question in the minds of those best acquainted with the circumstances, as to whether or not any of the means suggested for saving the men could have been successful. There is room for doubt, based on past experience of engineers with somewhat similar fires, as to whether or not the men could have been brought safely through the fire zone in the skip. The matter of ventilation in the Argonaut has not been as well understood as is necessary for an intelligent discussion. Fresh air was drawn into the lower workings through the main shaft, and on account of the depth and extent of the workings the proper ventilation of these lower levels had already become a serious problem. Intermediate levels had to be shut off by doors, and the circulation of air depended on unimpeded entry at one shaft and exhaust through the other, after passing through the lower workings. It was probably only a short time after the start of the fire that caving began in the shaft. There are not enough data at hand to warrant the assertion that enough fresh air could have been forced to the bottom of the mine to keep the men alive, bearing in mind the obstructed condition of the main shaft, even had the Muldoon fan been stopped or reversed at once. It is quite likely that had this been done, it would have been found that as soon as caving began in the Argonaut shaft, the air would have begun to short circuit in the middle levels from the Muldoon shaft and its interconnected raises across the intervening ground to the Argonaut shaft, as for example at the 2400 level.

Disastrous underground fires in California metal mines have been of such rare occurrence that no one has realized the potential dangers from this source. Safety lies in preventive measures, rather than in elaborate fire fighting plans. Shaft timbering should be kept wet enough to prevent burning. Where two mines are working near together at considerable depth, the advantages of a connection in the deeper levels are too obvious to leave room for dispute. With properly protected electric wiring, there is really little danger of underground fire in the California gold mines. Where workings are dry and a great deal of timber is used, fire fighting apparatus should be at hand, as the chief value of such apparatus is in snuffing out small fires, before they get out of control.

Bunker Hill Mine has recently had another change of management, and those now in control have not yet (Jan. 7) decided on a plan for future operation. There was no important production during 1922. At present the mill is idle but the underground workings are being kept unwatered and repaired. Due to the fact that the present control is supposed to be in the hands of those owning the Original Amador Mine adjoining, the idea has gone out that it is planned to explore the latter through the Bunker Hill workings.

Central Eureka Mining Company's mill was idle most of the past summer during extensive improvements above and below ground, which were begun in 1921. The property is now equipped with a new steel headframe 85 feet high, new ore and waste-bins, 53-lb. T-rails in the shaft and electric hoisting equipment capable of working to a depth of 5500 feet. Milling was resumed the middle of August. At present, January 8, they are milling at the rate of about 150 tons a day or 4000 tons a month of ore averaging about \$9 a ton, according to Supt. Albion S. Howe. The deepest level is at 4100 feet incline, or 3800 feet vertical depth. The same company is still prospecting the South Eureka, but no important developments have been announced.

At the *Fremont Mine*, the development work during the year has given such encouraging results that the mill is being put in shape for operation, with the prospect of a long run in sight, in the opinion of Supt. B. I. Hoxie. The 1650 level from the Fremont shaft has been run north a total distance of 2500 feet. Hoxie reports that they have drifted 350 feet in ore on this level on the contact vein between the slate and the greenstone. He estimates an average width of eight feet of ore here, and with what was left in the mine when it closed, he thinks they now have enough for several years' milling. The 1950, 2350, 2550, and 2750 levels are being cleaned out. The Gover shaft, 1350 feet north of the Fremont shaft, is 1500 feet deep and will be made use of in the operations. Hoxie has installed a sprinkling system to prevent the possibility of a shaft fire.

The Kennedy Mine and mill have been in operation nearly all the year except for interruption at the time of the Argonaut fire. The mill is handling 200 to 270 tons of fair grade ore from the 3900 and 4050 levels. Legal skirmishing is still going on, preliminary to the suit filed by this company for \$500,000 damages against the Argonaut Mining Company and the cross suit of the latter against the Kennedy company for \$800,000.

The mill at the *Moore Mine* got into operation early in October. Difficulties and delays incident to initial operations, and trouble in getting out enough ore to keep the mill running, kept them from making much production the first two months. For about 23 days in December the mill of 20 stamps is reported to have crushed 2265 tons, yielding about \$6.35 a ton, with a rather high tailing loss. The low returns from the first operations, as contrasted with the reported high assays previously obtained, is attributed to poor judgment in stoping too great a width, as much as 32 feet in width having been mined and milled from the 500 level. Part of this is said to have been low-grade schist containing considerable low-grade sulphides. Alexander Ross, for many years foreman at the Kennedy Mine, has lately been put in charge of underground work, assuring proper attention for this important department of the venture.

The workings of this mine, as far as then opened, were described in the July chapter of MINING IN CALIFORNIA. Since then the 600 level (540 feet deep), has been opened and drifted 213 feet north and 50 feet south, with ore reported for about 100 feet in length on the north. A total crew of 65 men are employed, of whom 35 work underground, and 80 tons of ore are being milled daily. The grade of ore and concentrate is reported to be improving as more careful mining methods are being employed.

Plymouth Consolidated is the only mine in the county that has been continuously productive during 1922. A total of 92,500 tons of ore were crushed during the past calendar year, for a gross production of \$460,000, in round numbers, or \$5 a ton. Cost per ton and yield per ton have been very near together during 1922, and the tonnage of ore developed for each foot of development work has been low, as the ore has been occurring in rather small lenses. The work for the year was below the 3050 level. The shaft is 3400 feet deep, from which level a winze extends to 3890 feet. Preparations are being made (January 5) to open a new level at 3850 feet. Superintendent Stanley Arnot expresses satisfaction at the assays obtained and the general indications in sinking the last 140 feet of the winze, and the showing on the above date was very good. According to Arnot's figures, the total cost per ton averaged for the entire past year has been about 44 cents less than in 1921, but for December, 1922, there was another marked decrease. There has been, if anything, a decrease in labor efficiency. A total crew of 160 men are employed, of whom 110 are underground. The plants on this property for hoisting and milling have been models of advanced practice since this company reopened the mine. W. J. Loring is general manager.

The *Treasure Mine* was closed September 23. The mill had been operated intermittently during the first half of 1922 on very low-grade ore, but was closed in July. The present owners are said to have no plans for reopening. The lower levels were not profitably productive, although above 2300 feet the mine yielded enough profit to build up a small surplus. The operations had reached a depth of 3030 feet on the incline and the lowest level was at 2970 feet.

Off the Mother Lode in this county there was little actual production of gold noted in 1922 except at the Elephant hydraulic mine at Volcano, two or three smaller hydraulic mines and small scale quartz operations in the Defender district, which have not been visited on account of lack of time.

Calaveras County.

Carson Hill Gold Mines, Inc., has been the only producer on the Mother Lode within the county during the past year. This property now embraces Melones Mine Group, Morgan Mine Group, and Calaveras Group, of which the first two were under operation during 1922. Ore mined from the Morgan has been all from above the 1100 level; that from Melones Mine has come from the levels between 3600 and 4000 feet. The costs of certain mining items for Melones ore, which was raised through a winze, were about double those for Morgan ore. The combined properties produced during 1922 a total of 183,733 tons of ore of a gross value of \$1,035,000, in round numbers. Costs of operation have shown a downward tendency, but this is partly due to

increased duty of the milling plant. The thirty stamps of the mill are used for coarse crushing and amalgamation, followed by grinding in Hardinge mills and concentration. The concentrates, sands and slimes are all cyanided under contract. During the year past this mill made a splendid record, handling an average of 15,300 tons a month, giving the remarkable average daily duty of 18.44 tons per stamp with an average of 27.67 stamps in commission. The recovery from concentrates averaged 92% as per contract; from sands and slimes 67.69%, and average actual recovery from all products for 11 months of the year was 90.41%. Average cost per ton for operation and development during 11 months is reported by the company at less than \$4 a ton, but this figure, like many averages, is misleading and especially so in this case, because the costs for the two mines were so different. For ore from the Morgan Mine alone, the cost per ton on the basis of the above tonnage would be considerably less. For ore from Melones deeper levels the costs were higher on account of greater depth and the disadvantage of working through a winze. When the winze has been converted to a working shaft, costs of working this ore will be materially reduced, it is hoped. Meanwhile, the joint operation of the two properties is desirable due to the large available tonnages.

The same management has been prospecting several claims at Chaparral Hill, just north of Carson Hill. Surface trenching and underground work have been done on the Tullock, Hardy and Chaparral claims. This work is still being prosecuted with about 20 men.

Calaveras County is fortunate in having such an operator as William J. Loring. At a time when mining on the Mother Lode in the county had come to a standstill, and capital was diverted elsewhere or hidden in tax-free securities, he succeeded in raising money to reopen the *Morgan Mine* and developed in it fine bodies of good ore. This was done when the *Utica*, *Angels* and *Melones Mining Companies* had quit because of high costs, and the erroneous impression was going out that the Mother Lode in the county was exhausted. The Morgan ore bodies were found within a few feet of the *Melones* workings. Loring's later work in the deeper levels of the *Melones Mine* itself have revealed good ore, and the 4000 level in that mine is now being prepared for stoping. Loring has put in effect many advanced ideas in technical practice and in his relations with the public has exhibited a broad-minded and helpful spirit. In the four years beginning with 1919 the combined properties operated by *Carson Hill Gold Mines, Inc.* have produced \$4,161,166.

Among the East Belt mines of the county there has been considerable activity but only a few have been productive during 1922. *Sheep Ranch Mine* was a producer, with 20 stamps running during the first five months of the year. The mine and mill were closed down June 10. When last visited, late in 1921, this mine was producing about \$14 ore from small stopes between the 1300 and 1550 levels, and the 1700 level stope was being opened.

Bullion Hill Mining Co., six miles north of Murphy's, was a satisfactory producer during the year, with a 5-stamp mill.

In the West Point district, the mines of which were described in the January, 1922, issue, the year started with promise, as the *Lone Star* and *Keltz* properties were both being prospected by a well-financed company and it was hoped that one at least would show enough ore to

justify a mill. The operators quit early in the year. Some production of high-grade ore was made by a few small operators in this district, among whom the work of W. W. Gibson at the *Columbus Mine* was of interest because of the high grade of ore found there.

At the beginning of 1923 the *Bernardi Mine* in the Mokelumne Hill district is reported showing up well at 200 feet in depth. The *Lamphyre Mine*, a mile south of Mokelumne Hill is reported in process of being unwatered. At the *La Fortuna (Lucas) Mine*, on Mokelumne River, a half mile upstream from the bridge on the Jackson-Mokelumne Hill road, work is going on through an adit and winze. The *Comet Mine*, on the river near Railroad Flat, is also said to be making a promising showing. At San Andreas, a small crew is rehabilitating the *Ford Mine*, now called the *Apex* and electric equipment is being planned for unwatering. Work is continuing underground at the *Triple Lode (Blair) Mine* a mile and a half south of Altaville and was carried on during most of 1922. Lack of time has prevented visiting the East Belt mines of the county during 1922.

Numerous small placer mines are active in the county at the beginning of the year. A few men are working at the *McCann Mine* and the *Red Hill Mine* near Mokelumne Hill, and at other properties near San Andreas. At the *Noce Mine*, five miles east of Mokelumne Hill, F. H. Rindge of Stockton is continuing work and is putting up a hoist. The *Glenn Mine*, three miles north of Mountain Ranch, is to be hydraulicked the present season. Just north of Altaville, the *Victor Land and Mineral Company* is operating the mine formerly called the Reiner, through a shaft 360 feet deep. They found that their shaft was on a high reef of bedrock and the inflow of water was so heavy that it was thought impracticable to sink it deeper by the usual method. A flat winze was therefore driven to bottom the channel, and a drift run back under the shaft, which was then completed by raising. Two drifts have been run nearly east to explore the Central Hill Channel and this channel is now being followed upstream. It is reported to be about 80 feet wide. Small blocks of ground that averaged \$5 and \$6 a ton according to Supt. J. A. Montreeville, have been breasted northwest and south of the shaft by this company. These areas were a little higher than the main channel and have been called separate channels by the operators. At present, gravel is being washed in a small mill which is only saving the gold in the free wash gravel. The gravel in this channel is cemented in the channel proper and requires a better mill. The mine is equipped with a good hoist and surface plant. This company plans to drift on the Central Hill channel eastward to the end of their property, about a mile.

There has been some activity on the claims of the *Bishop Estate Company* on the Central Hill channel at Vallecito during the past year. The company has had a great deal of geological work done lately by Mark N. Alling.

There has been no copper production during the year from this county, but the announcement has just been made that the *Calaveras Copper Company*, with extensive mines and reduction plant at Copperopolis, plans to resume work early this year and to make extensive improvements.

Tuolumne County.

Belmont Shawmut Mine between Chinese Camp and Jacksonville, has been the only producer on the Mother Lode in this county during 1922. When last visited in November, this company was running 40 stamps of the mill. The workings have reached a depth of 3213 feet, on the dip, below the apex. A total crew of 125 to 130 men are employed, of whom about 75 work underground. Using the system of reduction described in the last monthly chapter, this company has achieved a low milling cost, and in point of total cost of mining and milling has reached almost as low a figure as that achieved at Carson Hill Gold Mines, where a much greater tonnage is handled.

The mill and surface plant at the *Clio Mine* south of Jacksonville was burned down late in the summer. Plans were announced for rebuilding.

The *Crystalline Mine*, a mile and a quarter from Jamestown on the Mother Lode was unwatered early in the year by the Tonopah Mining Company. The drift on the 600 level has been run north the entire length of the claim. Supt. T. C. Black reports that when the water had been removed, the shaft below the water-line was found to be in almost perfect condition and little expense was required to put the workings into shape for operation. The mine yields about 10,000 gallons of water a day, which comes in mostly on the 300 level. According to Black, no particularly good ore had been developed up to November. The *Alabama* claim, adjoining the Crystalline on the north, will also be prospected by this company.

On Jackass Hill near Tuttletown, the *Chileno* and other claims of a large group have been prospected during 1922 by the Nevada Wonder Mining Company. A shaft has been sunk on the Chileno and a cross-cut adit run in the hill, but without developing ore up to November, according to Superintendent T. C. Black.

Plans were under way late in the year for unwatering the *Omega Mine* near Jamestown. No other activity was noted along the Mother Lode. As far as known, there was little, if any production from quartz mines on the East Belt in this county, although several were being prospected.

STRUCTURAL AND INDUSTRIAL MINERALS.

This section of the state contains many valuable deposits of the structural and industrial minerals, and while some of these have been developed on a good-sized scale, it may be said in general, that these minerals have lagged far behind as compared with the metals. They depend upon conditions that do not restrict the gold miner, whose product is so valuable that he can ignore matters of transportation, and does not need a near-by market for his goods, which are always in demand. With the increase in population on the Pacific Coast that is forecasted by many authorities, and with the accumulation of capital among our own people so that it will not be found necessary to go east to finance our industries, there can not help being a hopeful future for these less spectacular but indispensable members of the mineral family.

Brick and tile are manufactured in large quantities near Ione in Amador County and at Lincoln in Placer County. That section of

Amador County has large deposits of fire clay and white quartz sand that are only partly developed and are well located as regards transportation. The plant of Gladding, McBean and Company at Lincoln in Placer County is one of the largest in the country. They make a wide variety of clay products, including especially architectural and building tile and brick, and sewer pipe. The Lincoln Clay Products Company makes a speciality of shipping crude clay for many uses, from their pit near Lincoln. There are several shippers of crude clay from the Ione district, and one firm makes a speciality of fire brick. The market is limited only by the cost of transportation, which determines whether or not they can compete for more distant business.

Placer County has been known for over fifty years for the high grade of granite produced by the quarries at Rocklin and Penryn, but these have not been very active of late, due to the advent of cheaper but less enduring building materials.

El Dorado County is the principal producer of limestone in this portion of the state, but there are large deposits lying idle in the other counties of the district. The largest producer is Pacific Portland Cement Company's Mountain Quarries property a few miles north of Cool, which furnishes lime for cement. Another large quarry below Shingle Springs has been for many years a heavy producer of high grade limestone for industrial uses.

Plans are under way early in January for the opening of a limestone deposit about two miles from San Andreas, and preliminary work has begun.

Tuolumne County has been noted for its marble for many years, and of late the product has begun to receive the recognition from western architects to which it is entitled. Two quarries are in operation and have found an increasing market during the past few years as the merits of the stone become better known. There are other marble quarries in Amador and Calaveras counties.

El Dorado County has several quarries of black roofing slate of which only one is in operation at present.

Promising chrysotile asbestos prospects have been noted in several counties of the district, notably in Tuolumne, Calaveras, Placer and Nevada. One property near Washington, Nevada County, has been productive for several years past. Another near Copperopolis has been developed far enough to make a promising showing.

Asbestos mining has good future possibilities on this coast, but seems to be hard to finance because of the unwillingness of the large consumers to help open properties, in spite of the high prices they pay for Canadian fiber and the heavy freight rates. At this writing, a plan is under way for the proper financing of the Pacific Asbestos Corporation, owners of the deposit near Copperopolis.

There has been a small production of barytes during the year from one property in Nevada County near Liberty Hill. Other prospects have remained undeveloped as far as known. The new tariff of \$4 a ton on crude barytes and \$7.50 on ground barytes should encourage the opening of known deposits.

Chromite has remained inactive during the past year and only a small production was made from one property in Placer County.

Silica sand has been produced in the past few years at a plant near Ione. Quartz could be produced cheaply from a great many properties

in the district, but the local demand is small and there is only a little production annually in the district.

Soapstone is produced in El Dorado County near Shingle Springs and farther west near the railroad, and finds a market for use in roofing.

A magnesite deposit was opened up near Chinese Camp during 1922, and shipments begun.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

REVIEW OF ACTIVITIES IN 1922 WITH NOTES ON THE OUTLOOK FOR 1923.

During the past year field trips were made into Madera, Mariposa, Mono, San Benito, and Tulare counties, and the mining activities in these counties were quite thoroughly covered. Hurried investigations were also made of a few reported activities in Alameda, Contra Costa, Glenn, Napa, San Mateo, and Santa Clara counties.

Routine office work required much of the engineers' time. These duties and the resignation of Mr. E. S. Boalich from the staff in the San Francisco office made it impossible to adequately cover the twenty-eight counties in this district, and the monthly reports on the mines and mineral resources have been unavoidably meager at times.

The San Francisco division takes in the central, western, and valley counties extending from Mendocino and Glenn in the north to and including Monterey, Kings, and Tulare in the south; also Fresno, Madera, Mariposa and Mono on the eastern side of the great valley.

The district includes about three hundred miles of the Coast Range with the foothills and valleys to the east, and a considerable portion of the foothill and high mountain belt of the Sierra Nevada; consequently a great variety of commercial minerals are produced, including most of the structural and industrial materials, as well as the fuels and metals.

In this review, the fuels, petroleum, and natural gas, although in point of value the most important mineral product, will be omitted; developments in the oil fields of the state being found in the résumé of the petroleum industry by Mr. R. E. Collom, State Oil and Gas Supervisor.

METAL MINING.

In the district under consideration gold production comes mainly from Sacramento, Mariposa, and Mono counties, with lesser amounts from Stanislaus, Fresno, Madera, and Merced.

In the production of gold, Sacramento County ranks fourth in the state, with an annual production ranging from one and one-half to one and three-quarter million dollars, obtained almost entirely from dredging operations by the Natomas Company of California at Natoma.

Other gold dredge operators are the LaGrange Gold Dredging Company at LaGrange, Stanislaus County, and the Yosemite Dredging and Mining Company at Snelling, Merced County. The old dredge of the LaGrange Gold Dredging Company was replaced during the year by a new dredge with larger buckets.

The Yankee Hill Gold Mining Company's dredge, which was wrecked in the Stanislaus River below Knight's Ferry shortly after launching in 1920, has been sold and dismantled.

Dredging operations as a whole will show a normal output for 1922.

In Mariposa, Mono, Fresno, and Madera counties quartz mining prevails, but there is also a small gold production from surface placers, particularly in Fresno County. Interest in gold quartz mining in these counties has increased noticeably, new activities being most pronounced in Mariposa County.

The increased activity during 1922, in most cases probably represents money put into the mines in examination work, development and new equipment rather than increases in actual mine output, but after a long period of closure, such expenditures are unavoidable.

The results of renewed activity will no doubt be shown by a comparatively large increase in gold production from Mariposa County during 1923.

The Original Mining and Milling Company at Clearing House and the Virginia Belmont Mine, three miles south of Coulterville, were in operation and producing during 1922. The Bobbie Mining Company were developing. They erected a new mill on their property in the Moore Hill district. The B. V. D. Mining Company did considerable development work and erected a mill at a new prospect about one-half mile southwest of the Bobbie. The Little Wonder Mining Company was developing its property near Hite's Cove.

Two of the most important mines in the south half of the old Mariposa Grant, the Mariposa and Princeton, formerly large producers, have been reopened. The Quail Mine has been examined by Eastern parties, and the Ruth Pierce has been undergoing repairs with a view to early resumption of mining. The San Domingo Quartz Mine has been bonded, and a bond has also been taken on the Honeycomb, St. Gabriel, and Silver Lead mines by the Simpson Mining Company. The 5-stamp mill was overhauled and development work started. The Texas Hill Mining Company has been actively developing their property in the Kingsley district.

In a new adit at the White Oak Mine five feet of good ore was opened up during recent development.

Unconfirmed reports state that arrangements also have been made for the reopening of the old Mount Ophir Mine at Mount Bullion, and a number of other mines in this county. It was at the Mount Ophir Mine that the 50-dollar gold slugs were minted in the early days.

In Madera County the Kroramick Mining Company, owners of the old Texas Flat and other properties near Coarse Gold, have carried on development work for the past several years and have a large tonnage of ore blocked out. This mine should soon be on the producing list. Among the smaller properties at which there was some activity during 1922, may be mentioned the Mud Springs Mine, Hornet's Nest Mine, Eagle Mine, and the Stayton Mining Company. Most of these properties are equipped with arrastras or small mills of some kind. Gold production in Madera County will not noticeably increase in 1922, but it will likely show some improvement during the present year.

The mines in Mono County have always operated under adverse natural conditions due to the rugged topography, lack of transportation

facilities, sparse population and their generally isolated situation. In spite of these handicaps, prospecting and development on a small scale have been carried on, and the outlook for 1923 points to some improvement in conditions.

In the Antelope Valley, or West Walker district, the Golden Gate Mine and mill has been in quite steady operation. The famous Silverado property in the Patterson district has been acquired by the Mono Mines Company, who expects to open it up on a large scale.

In the Masonic district some work has been carried on at the Pittsburgh-Liberty Mine; the Success Mine and at the Faudre and Welsh, and Brownie Groups.

The Visalia Masonic Mining Company opened up some rich ore in their property known as the Chemung Mine, and equipped it with a mill which was put in commission late in the year.

Leasers have been working in a small way at the Standard Mine in Bodie.

At Mono Lake three companies were putting up plants for the recovery of gold from the lake water. Their success is problematical, but if recovery can be accomplished on a commercial scale, such operations would add considerably to the gold output of the county. It is claimed that as high as twenty cents per ton of water has been recovered in experimental work.

Mining in the Benton District has been very quiet, with only a little development work going on at the Comanche Mine and at the Diana Development Company's property.

The Bishop Community Gold Producers Mining Company has been actively developing the Casa Diablo Mine in the district of that name, during 1922. Several thousand feet of development work was completed and the property equipped with a sawmill, electric generating plant, 10-stamp mill, four-mile electric transmission line and eight-mile water pipe line.

In Tulare County, gold, silver and molybdenum properties have received attention. Warner Barnes and Company have reopened the Bald Mountain Mine in the White River district and the 5-stamp mill has been put in shape to run. Preparations have been made by the owners of the Florence G. Mine to renew mining, and both these properties should be producing early in 1923.

The Deer Creek Silver Mining Company started exploratory work on an old silver mine situated eleven miles southeast of Porterville in an unorganized section adjoining the White River district. This mine was last worked in the 60's or 70's, at which time the ore was hauled to Tipton and shipped.

Kaweah Molybdenum Mines Company did a small amount of development work on their molybdenum deposit in the Mineral King district. The property comprises sixteen claims.

Outside of the operations mentioned, the only other metals of importance in the district, as far as activities during the past year are concerned, were quicksilver and manganese. Quicksilver production was almost at a standstill during 1921 and 1922, but there is promise of resumption of mining on a much larger scale and at more mines in 1923 than for some time past.

The McCumber-Fordney Tariff Act, which took effect late in 1922, placed a duty of twenty-five cents a pound or \$18.75 per flask on imports, and this will be of material aid to California operators.

During 1922 the New Almaden Mine in Santa Clara County and the mine of the Western Mercury Company at Cloverdale in Sonoma County were operated on a reduced scale. A small production was also made by Patriquin Bros. from the Dawson Mine, Kings County. Mines that are reported as preparing to resume operations in the immediate future are the Knoxville in Napa County, which will be reopened by H. W. Gould; the St. John Mine in Solano County; the Wideawake, situated on the line between Colusa and Lake counties, by the Consolidated Exploration and Development Company; and the well known New Idria mines in San Benito County.

Quicksilver production for 1922, like that of 1921, will be light, but there will no doubt be a marked increase during the present year.

Two plants for refining or concentrating low-grade manganese ores are in operation, one in Berkeley and one at Redwood City.

The plant in Berkeley, owned by the Consolidated Manganese Company, uses electro-magnetic separation to eliminate silica. The American Manganese Products Company at Redwood City refines silicious manganese ores by a patented chemical process and produces high-grade manganese dioxide, especially suited for dry-cell batteries.

Ore shipped to the above plants came from San Joaquin and Stanislaus counties. No other manganese mining operations were noted in this district.

NON-METALS.

Omitting petroleum and gas, there still remains a large number of structural, industrial, and saline minerals, that are produced in the San Francisco district. Chief among these are cement, miscellaneous stone (crushed rock, etc.), brick and tile (including pottery clay), granite, magnesite, salt, limestone and marl, diatomaceous earth, asbestos, dolomite, feldspar, gypsum, coal and peat.

During the year just passed there has been a growing interest manifested in mineral products of this nature. Freight rates and haulage costs are important factors in the commercial exploitation of the industrial minerals, and the search for supplies close to transportation facilities and the Bay district has been keen.

Established cement plants in this district, one each in Contra Costa, San Benito, Santa Cruz and Solano counties, enjoyed a very prosperous year. Limestone enters largely into the manufacture of the finished material. It is reported that the Riverside Portland Cement Company has acquired a large holding of limestone in Tulare County near Springville. Limestone deposits in Northern California, even though at present undeveloped, suitable for the establishment of cement plants, have a potential value that will no doubt be realized in the near future.

The use of limestone for agricultural purposes, as an indirect fertilizer and soil corrective, is increasing in California, and there has been considerable development along this line. A deposit at Jenkins Hill above Bagby has been leased for the establishment of such a plant. The Bernal Marl Fertilizer Company operates a quarry and pulverizing plant near Eden Vale, Santa Clara County. A steam shovel is used in mining. The mill has been rebuilt and enlarged and has a capacity

of 500 tons per day, requiring 500 horsepower of electric energy. In San Benito County the Pacific Coast Steel Company has bonded and is developing a limestone deposit about ten miles southwest of Hollister. A spur track will be run to the property if sufficient tonnage is developed.

Kaweah Lime Products Company has opened up a new quarry face and increased the capacity of their grinding plant at Terminous, Tulare County. From 90 to 175 tons per day of agricultural lime, paving dust and cement pipe stock is produced.

Pennywell & Company of Lemon Cove are erecting a plant at Terminous for the manufacture of a mineral compost composed essentially of limestone, tricalcium phosphate and sulphur.

The Pacific Limestone Products Company of Oakland has purchased the W. Coplatzi limestone property at Santa Cruz, consisting of fourteen acres. This quarry produces considerable agricultural limestone.

The stone industry, including crushed rock of all kinds, paving blocks, sand and gravel and grinding mill pebbles, follows cement in point of value, and forms the next largest subdivision of the structural materials. The larger producing counties in the district, in order, are Contra Costa, Sacramento, Alameda, and Fresno. A portion of the production from Fresno and Sacramento counties is selected pebbles from the gravel beds of the San Joaquin River and from dredge tailings. These are used as a grinding medium in tube mills at metallurgical plants.

The miscellaneous stone industry is on a firm basis and the business in 1922 was probably somewhat greater than in 1921. Prospects for the coming year are excellent.

Clay products, including brick, tile and pottery clays, is another important subdivision fairly well developed in this district and represented by one or more operations in about half the counties included therein.

The California Pottery Company started operations in the first unit of their plant at Merced. They met with success and plans were immediately made for increasing the installation of four kilns, at present operating, to sixteen.

In Contra Costa County, the Pacific Sanitary Manufacturing Company, organized with a capital of \$2,000,000, took over three existing plants, an enameled iron works at North Richmond, and two potteries in San Pablo. Plans are under way for extensive additions and improvements that will increase their capacity about 100 per cent.

The S. P. Brick Company of Exeter, Tulare County, increased the capacity of their plant and now manufactures hollow building tile, as well as brick.

The West Coast Porcelain Company's plant at Millbrae, San Mateo County, has operated steadily, and the plant of the Homer-Knowles Pottery Company at Santa Clara, constructed in 1921, began operations in 1922. The latter company produces high-grade white hotel crockery and chinaware.

Granites of superior quality for building, monumental and ornamental purposes are produced in the district in Madera and Tulare Counties. In Madera the McGilvray-Raymond Granite Company and the Raymond Granite Company have been operating at full capacity supplying granite for various new buildings in San Francisco and Sac-

ramento. The California Granite Company, operating quarries near Porterville, Tulare County, and Rocklin, Placer County, has also been in steady operation. The outlook for continued good business by the granite producers is excellent.

Magnesite is one of the minerals that is mined almost exclusively in the San Francisco Field division, as the bulk of the state's production comes from Fresno, Napa, San Benito, Santa Clara, Sonoma, Stanislaus and Tulare counties. The magnesite industry has been in a rather weak position since war-time activities ended; however, conditions improved in 1922 as compared to 1921, and this improvement bids fair to continue during the present year in even greater proportions.

During the year mining was carried on at the White Rock Mine in Napa County by C. S. Maltby, who has taken it over. The Western Magnesite Development Company's property in Santa Clara County, also under lease to C. S. Maltby, was likewise producing during 1922. Some shipments were made from a deposit near Madrone in Santa Clara County. In Stanislaus County there was one producer on Red Mountain, the magnesite being shipped to Patterson for calcining. Some magnesite was also shipped from Piedra, Fresno County, and the Sampson Magnesite Company produced a little from their deposit in San Benito County. The Sierra Magnesite Company, subsidiary of the National Kellastone Company, operated their mines and calcining plant at Porterville, Tulare County, on a fairly large scale. The Hoff Magnesite Company operated a plant in Oakland, manufacturing magnesite stucco, flooring, etc.

The Tariff Act of 1922 placed a duty on imports of both crude and calcined magnesite, and this has helped to place the industry on a firmer basis.

Asbestos, diatomaceous earth, dolomite and gypsum deposits have received much attention during the year, and there has been considerable development work on deposits of these minerals.

In San Benito County, the California Asbestos Mining Company took a lease and bond on the Long-Ryan Asbestos Mine near Hernandez, and were equipping it with a mill for the production of fiber.

A deposit of chrysotile asbestos, the first recorded occurrence in Napa County, was opened up during the year by James S. Brogan and R. R. Norton. Nineteen claims have been located on what is apparently a large deposit of short-fiber chrysotile.

A number of diatomaceous earth deposits have been investigated, and one or two small producers have been developed in this division. One deposit is near Pinole, Contra Costa County, and one in Sonoma County.

Dolomite has been produced steadily from deposits near Hollister, San Benito County, and gypsum has been developed in Fresno County.

There is a growing demand for practically all of the industrial and structural minerals, and as deposits at present producing are exhausted, others suitably located are eagerly sought.

Impetus was given to the coal mining industry in the district when the Stone Canyon Coal Mine in Monterey County was reopened, in the latter part of 1921. Operations continued during 1922 until after the middle of the year and production reached approximately 200

tons per day. It is reported that the coal had to be rehandled many times between the face and the railroad cars, that mining costs were excessive, and that the mine could not be profitably operated unless at least 500 tons per day was produced. The output could not be raised to that figure, and the mine is again idle. Seventy-five men were employed during the period of active development.

The San Benito Coal Mining Company has been carrying on development on a small scale at their coal mine near Mendota, San Benito County. A 6-foot vein of coal of sub-bituminous character has been opened up.

One of the undeveloped fuel resources of this district is peat. There has been considerable production of peat in California, usually under the name of humus, and used for agricultural purposes, but to date its use as a fuel in California has not been developed. However, there has been some inquiry in regard to the peat resources of California, during the past year, and the following data abstracted from a reprint of Transactions of Commonwealth Club of San Francisco, is informative:

"The large overflowed areas of the interior valleys of California have formerly supported and, except where reclaimed, still support a healthy growth of tule, duck weed, cattail and many other aquatic plants. The entire area both reclaimed and overflowed, must, therefore, be underlaid by peat deposits. The thickest of these is supposed to underlie the area following a line traced around the edge of the marshes and extending from Carquinez Straits to Stockton to Rio Vista, closing at the point of commencement again and covering an area in all of approximately twelve townships, 432 square miles, or 276,460 acres, with peat to a thickness of from six to eighty feet, or an average of forty-three feet. A large portion of this expanse, particularly in the eastern part, has been covered by debris from our early hydraulic mines, while in other portions the peat is more or less sandy. The acreage noted is therefore divided by two, giving as a result 138,248 acres. Of this area 60,000 acres are known to contain good peat to a depth of at least six feet or more. In one acre of land 200 tons of machine dried peat are recoverable for each foot of raw material. The 60,000 acres will therefore contain 60,000 x 6 x 200 or 72,000,000 tons, which will be placed as proved. The 138,248 acres with forty-three feet of peat would contain 138,248 x 43 x 200, or 1,188,932,800 tons. The amount of peat in this area under consideration is given as follows:

Proved -----	72,000,000 tons
Possible -----	1,188,932,800 tons

"No attempt has been made at any accurate estimate in the preceding figures, as such would be impossible from any existing data. It is highly probable that a large portion of the 'possible' area will be found unavailable because of mixture with silt. It is also unfortunate for the peat industry that this land is among the most valuable in California for agricultural purposes, as it is questionable if peat products will prove more remunerative than those of agriculture.

"Shallower peat beds are also known to exist in parts of Sutter and Yolo Basins, throughout the marshes on San Francisco Bay, in the marshes near the mouth of the Salinas River and in that portion of Klamath Lake located in California. These areas do not begin to compare in possibilities with those of the lower Sacramento and San Joaquin Rivers."

The principal saline mineral produced in this district is common salt obtained by evaporation of sea water at plants on San Francisco Bay and at Monterey Bay. Alameda County is the largest producer in both this district and the state.

As mentioned previously, a large portion of the engineers' time in this district is taken up in replying to written and personal requests for information relative to the mines and mineral resources of the state. With the publication of lists of mineral products and deposits wanted, and for sale, in the monthly chapters of the State Mineralogist's Report, a fertile field for practical assistance in development was

opened up, and a few words regarding this work may not be out of place.

It was expected that this service would develop into a rather one-sided affair; that is, that there would be a very large excess of materials offered for sale, over those that were wanted by buyers. However, during the entire year, the total number of items, including minerals of all kinds, undeveloped deposits and mines offered for sale, has only exceeded the specific requests for mines of one kind or another, undeveloped mineral deposits or mineral products, by the small total of twenty-six.

This would indicate that there is a strong demand for the commercial minerals, which, if met, must inevitably lead to greater development.

Requests for a source of supply of various products have come from New York, Pennsylvania, New Jersey, Illinois, and other eastern manufacturing states, as well as locally, from both large manufacturing companies and individuals, whose variety of requests easily lead one to believe that everything in the nature of a mineral product is found in California. Fortunately, it is seldom that a correspondent or caller can not be placed directly in touch with producers of the required product or owners of deposits.

Busy individuals and corporations usually accept such assistance as a public bureau of this kind offers, as a matter of course. It is therefore gratifying to note that the files of this office contain a number of acknowledgments of the satisfactory consummation of purchases or sales, directly due to this service, as well as others, stating that negotiations are under way or properties are being investigated.

Of these, some are from prospectors, one of whom has written as follows:

SHOSHONE, CALIFORNIA, January 9, 1923.

CALIFORNIA STATE MINING BUREAU,

Ferry Building,

San Francisco, California.

DEAR SIR: I'm sending sample of mineral in a match box. I would like to know if there is a possible chance of borax being in it—or other salts. It's out of the borax formation here. It means a deal going through if there is any kind of borax in it, with my other borax claims.

I have not received the November and December Monthly Chapters of "Mining in California."

I got in touch with some of the people who want minerals, in your last Monthly Chapter, and I'm sending samples away.

Now I wish to say—whoever gets up the Monthly Chapter of "Mining in California" is surely a master in the mining game—even a rough-neck miner and prospector like me can understand it, and he gets in touch with the mining man and ore buyers, etc. It does more, the chapters, to build up the mining industry than all the newspaper advertisements in a million years—because you get in touch with the buyers—one live mine brings 50 moneyed men in camp like bees in a water bucket. If the funds should run low—and the State don't contribute it—I'll put all I can to keep the Monthly Report going; and I will rustle more—and if all the prospectors do likewise it will help.

Hoping this meets your good will, I remain

Respectfully,

(Sgd.) ROCKY MT. GEORGE,
Death Valley Prospector, California.

This assistance in development is especially appreciated in the mining of the nonmetallic minerals, the marketing of which differs widely from that of the metals.

A letter was recently received from a company in Detroit, Michigan, which is putting a new automobile accessory on the market. Each instrument will require about one-half pound of quicksilver. This use for the metal is entirely new. As they expect, when in production, to average two thousand instruments per day, their control of a mine or primary source of supply is imperative. It is to such requests that the State Mining Bureau alone can supply unprejudiced and authoritative information.

The Bureau is kept in close touch with industrial demands through these inquiries. Arsenical ores, long penalized by smelters and the bane of cyanide plants, are now wanted, due to the present demand for arsenic as an insecticide in fighting the boll-weevil and other pests. The records and reports of the Bureau, since its inception, are proving invaluable in locating many such rarely-wanted minerals when a demand develops.

It is hoped that the service offered producers and consumers will be even more valuable to the mining industry during 1923 than it was during its initial year, 1922.

LOS ANGELES FIELD DIVISION.

M. A. NEWMAN, Mining Engineer.

REVIEW OF MINING FOR 1922.

Scope of Industry:

This division consists of the following eleven counties in the southern part of the state: San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego Imperial, Riverside, San Bernardino, Inyo and Kern counties. In area, these counties cover 66,543 square miles.

Among the minerals found in this region are: Antimony, asbestos, barytes, bituminous rock, borax, clay, cement, chromite, diatomaceous earth, dolomite, feldspar, Fullers earth, gems, gold, graphite, granite, gypsum, magnesite, manganese, marble, mineral paint, mineral water, molybdenum, natural gas, petroleum, potash, pumice, quicksilver, salts, silver, soda, stone, strontium, talc, tungsten and zinc.

Reference will only be made to the most important minerals mined during the year, and then only to such salient features as may prove of interest and value to the public.

Production for the Year 1922:

The actual figures for 1922 will probably not be available, as regards the mineral production in this district, until about the middle of this year. However, if we glance at the figures for 1921, we can make a fair estimate of whether there should be an increase or decrease in any particular mineral, if conversant with the general business conditions affecting it. In the April to October number, inclusive, of 'Mining in California' can be found the actual production of any mineral, for 1921.

In 1921, the value of the mineral production of this district was \$213,014,760. Of this amount, approximately \$188,850,696 should be

credited to petroleum and natural gas leaving \$24,164,064 to be apportioned among the other minerals, as follows:

Borax	\$338,905
Cement	4,633,437
Clays, brick, tile.....	3,941,491
Gold	383,176
Potash	211,067
Silver	3,299,543
Talc	120,625
Miscellaneous stone	2,962,127
Balance	8,273,693

Let us now briefly discuss the outstanding features of 1922 production.

Metallic Group. There was practically no production of antimony, chromite, molybdenum, or tungsten during the year.

There was considerable scouting for gold mines, and quite a number of prospects are being reopened. This is especially true in the Randsburg district. In this district the Yellow Aster, King Solomon, Baltic, and Black Hawk operated during the year, and a number of mines in the so-called Stringer zone are being reopened. In the Mojave district, the Yellow Dog Mine is being developed. This property, as a prospect, has a remarkable showing of high-grade gold ore. It lies but a short distance from the old Exposed Treasure Mine, which, in times past, had a large gold production. In the Big Bear region, San Bernardino County, the Gold Mountain property operated both mine and mill during 1922. It was reported the property has recently been sold to an Arizona syndicate. In the Black Hawk district, San Bernardino County, Voorheis and Del Mar are developing the Arlington group of claims. They claim to have a very large tonnage of \$4 ore, which they believe can be profitably worked. It is expected that a milling plant will be erected on this property sometime during 1923. The Zenda Mining Company, in the Amalie district, Kern County, resumed operations during the year, and is now running its 100-ton plant. The Tropico Mine, near Rosamond, also operated steadily during the year.

The rise in the price of lead from around 4¢ to 7¢ during the year was reflected in increased operations in the Cerro Gordo, Darwin and Tecopa lead mining districts. The Cerro Gordo Mines Company operated its 50-ton lead concentrating plant at Keeler to full capacity during the year. The Darwin Mining Company was leased to the Darwin Leasing Company. This company put in operation its 80-ton mineral separation flotation plant, at Darwin. At Tecopa, the Tecopa Consolidated Mines Company operated its 100-ton flotation plant to full capacity. The Carbonate Mine, near Zabriskie, resumed shipments to the smelters, as well as a number of other small properties mining high-grade silver-lead ore.

The silver bearing area of the Randsburg district surrounding the California Rand Silver, Inc., locally known as the Kelly Mine was the scene of much prospecting and shaft sinking, with the hope of finding other ore bodies of the richness and extent that the Kelly possesses. Fully thirty companies are actively mining in this region, some of which have found ore that may develop into bodies of commercial

value. Next to the Kelly, the Coyote, owned by the Randsburg Silver Mining Company, has developed a considerable tonnage of both shipping and milling ore.

The finding of ore in the Silver King shaft at a depth of 580 feet has given much encouragement to many of the companies. Ore of a milling grade is also reported to have been cut in the Grady shaft, at a depth of 975 feet. If this ore be cut again at an additional depth of 100 feet, the statement of some that it is only a one-mine camp will be subject to considerable modification.

Litigation over apex and extralateral rights between the Kelly and Coyote property is having a detrimental effect upon the conservative mining element who would like to enter the camp. While the camp does not possess the feverish activity that was seen at Goldfield, Tonopah or Divide, the general public is getting a much better run for its money, as it is practically all going into real development of the mines, for which the camp is to be congratulated. The dividend distribution of the California Rand Silver, Inc., during 1922, amounted to \$1,100,600, and the total dividends paid in the three and a half years of its existence have amounted to \$2,169,600.

The silver region of the Randsburg district will be treated in detail in a special bulletin to be shortly issued.

The amount of zinc mined during the year was negligible.

Non-Metallics: The most important minerals of this group mined during the year were borax, clay, diatomaceous earth, gypsum, limestone, potash. Cement, though an artificial product, is in this class.

The Sterling Borax Co., at Lang, did not operate during the year. So, practically all the borax produced, can be credited to the Pacific Coast Borax Company, with a small amount made as a by-product for the American Trona Company, at Searles Lake. An item of importance is the construction at present of a refinery at Wilmington, near Los Angeles, by the Pacific Coast Borax Company. This will enable the company to make a considerable saving in freight charges, as at present its borax is being sent to the Stauffeur Chemical Works at San Francisco and to Bayonne, New Jersey, for refining.

The Celite Products Company at Lompoc was the largest producer of diatomaceous earth. The Featherstone Company, at Covina, opened up its deposit during the year and placed its plant in operation and is now in the market with diatomaceous earth products.

The completion of a 25-mile narrow gauge railroad from Maria, a station on the San Diego and Eastern railroad, to the gypsum deposit of the Imperial Gypsum Company, in Imperial County, near the San Diego line, was the outstanding feature of the gypsum industry. At present the Imperial Gypsum Company is shipping 150 to 200 tons a day to the Blue Diamond Materials Company, at Los Angeles. The U. S. Gypsum Company, as usual, supplied the bulk of gypsum used as land plaster and by the cement plants as a retarder, from its deposit at Amboy.

The California Graphite Company, at San Francisquito Canyon, leased its property to the Flake Graphite Company. This company, the latter part of the year, operated the plant and sold graphite in the local market.

The American Magnesium Company is building a 30-mile mono-rail line from its magnesium sulphate deposit to a point 6 miles south of

Trona. It also proposes to build a refining plant at either Los Angeles or San Pedro to manufacture magnesium carbonate and Epsom salts.

The American Trona Company on Searles Lake, resumed the manufacture of potash during the year. The West End Chemical Company, at Searles Lake, also manufactured a small quantity of potash and borax.

Around Owens Lake, the Natural Soda Products Company was the largest producer of soda.

Due to the great activity in building, the cement and sand crushing plants, as well as those engaged in the manufacture of brick and tile, experienced an extremely profitable year.

In the clay industry, an important deposit has recently been opened by the Pacific Clay Products Company, six miles south from Oceanside, San Diego County. This clay deposit, found on the Kelly Ranch, is said to be the equal, both in quantity and quality, of anything thus far discovered in southern California.

Considerable attention was paid to the oil or tar sands in San Luis Obispo County during the year. The California Oil Corporation has erected a 200-ton pilot plant to treat sands from its deposit, 4 miles south of San Luis Obispo.

The American Canadian Corporation also intends to work the sands from its deposit in the Tyber field, using the so-called McClave Process for the recovery of the oil.

Outlook for 1923:

It is reasonably safe to prophesy that both metal and non-metallic mines will be more active during this year than last, with the possible exception of those of silver. As is well known, there now remains but 60 million ounces of silver of the 207 million sold during the war, to be bought under the Pittman Act, and this purchase will probably be concluded sometime during the year. Unless some action be taken by Congress to stabilize silver, there will be nothing to prevent silver in the United States from conforming to the world market price, which now ranges between 60 and 70 cents per ounce.

The McCumber-Fordney Tariff will aid some producers materially, as nearly all the minerals have received additional protection. An example of this is the \$4 tariff placed on silica, which was on the free list before. Quicksilver also receives a protection of 25 cents per pound, or \$18.75 per flask, while under the old tariff it had a 10 per cent ad valorem duty on it.

Another most important factor, which should contribute toward better conditions in mining during this year has been the reduction and stabilization of railroad rates, together with a fairly settled wage scale, thus enabling one to estimate costs of production with more certainty. This will allow many operators to embark in mining enterprises, with much more confidence as to ultimate outcome than in these last few years following the war. In other words, normalcy will more nearly have arrived in 1923.

Labor Situation:

There will probably be no reduction in wages in 1923, the present scale being stabilized, with the possible exception of Randsburg. At Randsburg, today, machine runners receive \$6 to \$6.50 per day, and

as long as the Pittman Act remains in force, this rate will stand. It is quite evident, however, that this wage scale will drop to the general wage level as soon as silver drops to the world market price. Due to the activity in the building trades and manufacturing industry, and also aided by the present immigration act, it does not appear as though there will be much surplus labor seeking employment at the mines. While, before the war, mine labor was among the best paid in the United States, today it can not compete against the building trades and many industries, and, as a result does not attract as good a class of men, as formerly.

Generally Recognized Needs of the Industry:

Cheaper power and better transportation facilities will do more to develop our mineral resources than anything else. Inasmuch as most of the mines are so widely scattered, especially in the desert regions, the cost of constructing power lines and building roads to districts containing but one or two small mines, would be prohibitive. With the general development and populating of the country, power lines and roads would be built and the small mine or camp will then be able to take advantage of such to its own economic benefit. The potential wealth of the desert regions is immense, but its exploitation must necessarily be gradual and subject to the economic laws of production.

OIL FIELD DEVELOPMENT OPERATIONS.

R. E. COLLOM, State Oil and Gas Supervisor.

FEATURES OF 1922 PRODUCTION.

California broke all previous records in the production of 139,000,000 barrels of petroleum during 1922. This is an increase of 24 million barrels over the production of 1921. It represents one-fourth of the crude oil produced in the entire United States. The State Oil and Gas Supervisor estimates that the quantity of refinable crude produced alone, crude above 20 degrees Baumé, almost equalled the entire 1920 production of all grades of crude, which was 105,700,000 barrels.

The great increase in the production of refinable crudes is due to the flush production taken from the three intensively drilled new oil fields of Los Angeles and Orange counties. The total production of these fields was 41,000,000 barrels, distributed as follows: Huntington Beach, 11,500,000 barrels, Long Beach, 18,300,000 barrels, and Santa Fe Springs, 11,200,000 barrels. Santa Fe Springs, with 75 producing wells, and Long Beach, with 135 producing wells, are each producing more oil than the entire Midway-Sunset district which covers an area of 46,000 proved acres and has 2600 producing wells.

The rapid drilling in southern California caused a reduction in the price of crude in July, 1922, to 60 cents per barrel, for oil under 20 degrees Baumé. From that time the price remained firm until January, 1923. On January 5, 1923, prices of the lighter grades of crude, above 20 degrees Baumé, were reduced. This reduction, being placed upon the lighter grades only, caused that portion of the state's petroleum coming from the flush production of the new fields to bear its just burden of the general situation of overproduction. The price reduction ranged from 1 cent a barrel on oil of 20 to 20.9 degrees Baumé to 50 cents on oil of 35 degrees Baumé, and above.

Consumption has been greatly increased by shipments of crude and fuel oil to the Atlantic Coast via the Panama Canal. Existing differentials in prices and transportation costs between California crudes and the so-called Mexican light crude are enabling California marketers to ship oil in quantities estimated as high as 50,000 barrels daily. This condition has created a new outlet for California petroleum.

California production still leads consumption by about 2,000,000 barrels monthly. In addition it is estimated that 2000 wells, with a normal output of about 72,000 barrels, are shut down. A large part of the oil shut in is heavy grade, less than 20 degrees Baumé. Oil in storage at the end of December, 1922, was about 1,000,000 barrels in excess of the storage of May, 1915, the previous high point for stored oil. Production at the close of 1922, not including potential production shut in, was 170,000 barrels in excess of the average production increase over the period 1911 to 1921, inclusive, and consumption was 35,000 barrels in excess of the average consumption increase over the same period.

Drilling was concentrated in the Huntington Beach, Long Beach and Santa Fe Springs oil field during 1922 and greatly curtailed in the other fields, especially in the San Joaquin Valley. Very few wells are being drilled in the oil fields of Fresno, Santa Barbara and Ventura counties. On the whole, however, more new wells were reported to the State Oil and Gas Supervisor in 1922 than in 1921. 1439 new wells were reported in 1922 and 1287 new wells in 1921. 799 new wells, 55 per cent of the drilling of the State, were reported in the three new fields: Huntington Beach, 193 wells, Long Beach, 348 wells, and Santa Fe Springs, 258 wells.

The present situation of overproduction in California is due primarily to the competitive drilling of offset wells on or adjoining small property holdings. In the development of each of the three new fields town-lot drilling has played a predominating part. Town-lot drilling should not be confused with close drilling or small acreages per well. The spacing of wells in several California fields, such as Kern River and McKittrick, are on an average basis of 2.0 to 2.4 acres per well. In these fields, however, are ten, twenty and forty acre tracts, or larger, in which wells were spaced according to what the operator considered was the most economical plan for extracting the oil.

In town-lot drilling every well is in a sense an offset well. The size and shape of the property controls the spacing of offset wells. They may be only 50 feet apart. Offset wells are not drilled so much for the purpose of developing and producing that oil to which each operator has an unhindered right, within his own property lines, as to get the oil lying under each side of the boundary line, which will move to the well first drilled into the oil sand. This condition is one of the recognized fundamentals of oil field development, and where properties are leased, the leases carefully safeguard each lessor's interest as opposed to the adjoining lessor. The necessities of drilling offset wells, to meet lease requirements, is therefore, one of the greatest contributory factors to forced drilling where small property ownerships are involved.

Intensive offset drilling necessitates abandonment of the principle of leaving certain quantities of recoverable oil in its underground storage until the maximum profit can be obtained, and then bringing the oil to the surface by drilling the wells according to established oil field

practice, as to spacing and careful drilling methods. Wells are raced to production and each new producing well calls for a number of offsets.

In the town-lot oil fields wells have been drilled as close as three to an acre. Town-lot drilling brings rapid recovery of flush production. For the industry as a whole it means serious over-production. For the operator drilling in congested areas there is not enough oil underground to yield a profit for all against the cost of each well, the productive unit.

The rate of production of California petroleum has its high and low points, like every other oil producing district, in the inexorable workings of the law of supply and demand. It would seem possible, however, by careful study of development problems and intelligent effort, to level off some of the extremely high and low points in the curve. Sometimes, when oil is badly needed, as in the war period, operators do not know where to get it, or how best to get the maximum output with minimum use of money, men and materials. In the present condition much oil is available but it is being produced like a big gusher out of control, because there is not the proper economic machinery to regulate the flow.

It is possible that some of the economic evils of town-lot drilling could be eliminated by carefully considered legislation. Such legislation should recognize the equitable right of every property owner in the oil under his land, whether a small lot or ten acres, and should rigorously prevent the exploitation of California's most valuable mineral resource by the stock jobbers and "uniteers."

From December 9, 1922, to and including January 13, 1923, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY:					
Pacific Oil Co.-----	35	30	24	92	Elk Hills
Pacific Oil Co.-----	35	30	24	101	Elk Hills
Berry & Ewing-----	31	32	24	9	Midway
Formax Oil Co.-----	36	32	23	2	Midway
North American Oil Cons.-----	4	11	23	2	Midway
Pacific Oil Co.-----	7	32	24	70	Midway
Pacific Oil Co.-----	31	31	24	257	Midway
Pacific Oil Co.-----	1	32	23	119	Midway
Pacific Oil Co.-----	35	31	23	73	Midway
Pacific Oil Co.-----	27	31	23	61	Midway
Geo. B. Bush-----	4	11	23	1	Sunset
Ash Oil Syn.-----	35	26	18	1	-----
LOS ANGELES CO:					
Standard Oil Co.-----	20	3	10	M-C 98	Coyote Hills
Bartholomae Oil Syn.-----	29	4	12	2-A	Long Beach
Belridge Oil Co.-----	29	4	12	1	Long Beach
California Co-Operative Oil Syn.-----	24	4	13	1	Long Beach
California Signal Syn. No. 1.-----	19	4	12	1	Long Beach
Cooper Petroleum Corp.-----	19	4	12	1	Long Beach
Cordary Syn.-----	19	4	12	1	Long Beach
Crown Syn.-----	19	4	12	1	Long Beach
Dabney Oil Syn.-----	19	4	12	22	Long Beach
Davis-MacMillan Syn.-----	30	4	12	2	Long Beach
Thomas Donley-----	19	4	12	Casa Blanca 2	Long Beach
Walter H. Fisher-----	30	4	12	3	Long Beach
Fred B. Foster & Co.-----	19	4	12	4	Long Beach
George F. Getty-----	29	4	12	4	Long Beach
Golden Eagle Oil Co.-----	29	4	12	1	Long Beach
Graham & Loftus-----	19	4	12	5	Long Beach
Graham & Loftus-----	19	4	12	2	Long Beach
Henderson Pet. Syn.-----	20	4	12	Dodge 2	Long Beach
Hub Oil Co.-----	24	4	13	L'kas Paulos 1	Long Beach
Hub Oil Co.-----	24	4	13	White 1	Long Beach
Huntington & Northern Pet. Co.-----	30	4	12	2	Long Beach
Industrial Oil Syn. No. 5-----	29	4	12	5-1	Long Beach
Interstate Oil Corp.-----	29	4	12	Babcock 1	Long Beach
Keck Syn. No. 5-----	30	4	12	5	Long Beach
K. Lundeen and M. E. Lee-----	30	4	12	2	Long Beach
C. L. McWhorter-----	19	4	12	Patton 1	Long Beach
Maier-Yerkes-----	30	4	12	1	Long Beach
Moore-Tobias & Couden-----	30	4	12	3	Long Beach
Moore-Tobias & Couden-----	30	4	12	4	Long Beach
Mutual Oil Assn.-----	30	4	12	2	Long Beach
Oceanic Oil Co.-----	29	4	12	3	Long Beach
Painted Hills Oil Assn.-----	19	4	12	3	Long Beach
Regina Pet. Corp.-----	24	4	13	1-A	Long Beach
Shell Co.-----	29	4	12	Alamitos 6	Long Beach
Shell Co.-----	29	4	12	Harriman	
Shell Co.-----	29	4	12	Jones 1-A	Long Beach
Shell Co.-----	29	4	12	Binkley 1	Long Beach
Shell Co.-----	29	4	12	Babb & Tucker 2	Long Beach
Shell Co.-----	29	4	12	Hutton Com. 3	Long Beach
Shell Co.-----	29	4	12	Goddard 3	Long Beach
Sherman Oil Co.-----	29	4	12	1	Long Beach
Transport Oil Co.-----	30	4	12	4	Long Beach
Union Oil Co.-----	30	4	12	L. B. Com. 8	Long Beach
United Oil Co.-----	30	4	12	Hass 3	Long Beach
United Oil Co.-----	30	4	12	Hass 4	Long Beach
Wellington Hopkins Oil Syn.-----	30	4	12	Long Curtis 1	Long Beach
West Continental Oil Co.-----	19	4	12	2	Long Beach
Western Pet. Co.-----	19	4	12	1	Long Beach
Western Star Oil Co.-----	19	4	12	Campbell 2	Long Beach
Western Star Oil Co.-----	29	4	12	Robinson 3	Long Beach
Union Oil Co.-----	2	2	12	La Merced 27	Montebello
Crawford Syn Oil Co.-----	12	3	16	1	Newhall
Anchor Oil Co.-----	6	3	11	2	Santa Fe Springs
Are Bee Oil Syn.-----	36	2	12	2	Santa Fe Springs
Associated Oil Co.-----	4	3	11	Benton 1	Santa Fe Springs
Boeske Oil Co.-----	4	3	11	3	Santa Fe Springs
Coalinga Mohawk Oil Co.-----	6	3	11	Mutual 1	Santa Fe Springs
General Pet. Corp.-----	5	3	11	Santa Fe 11	Santa Fe Springs
General Pet. Corp.-----	6	3	11	Santa Fe 8-B	Santa Fe Springs

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Contd.					
General Pet. Corp.	6	3	11	Hill Midway 2	Santa Fe Springs
General Pet. Corp.	6	3	11	Santa Fe 89-B	Santa Fe Springs
General Pet. Corp.	5	3	11	Anderson 53-A	Santa Fe Springs
George F. Getty	6	3	11	10	Santa Fe Springs
Hamilton Oil Syn. No. 5	7	3	11	5	Santa Fe Springs
M. & H. Oil Co.	36	2	12		Santa Fe Springs
McKeon Drilling Co.	6	3	11	Boeseke 2	Santa Fe Springs
McKeon Drilling Co.	4	3	11	B. G. & T 1-B	Santa Fe Springs
Santa Fe Chief Oil Syn.	35	2	12	1	Santa Fe Springs
Santa Fe Springs Oil Syn. No. 2	7	3	11	1	Santa Fe Springs
Santa Fe Springs Oil Syn. No. 3	7	3	11	1	Santa Fe Springs
Security Oil Syn.	7	3	11	1	Santa Fe Springs
Southern California Oil Co.	6	3	11	1	Santa Fe Springs
Standard Oil Co.	6	3	11	Walker Com. 8	Santa Fe Springs
Standard Oil Co.	6	3	11	Koontz 4	Santa Fe Springs
Standard Oil Co.	6	3	11	Johnson 4	Santa Fe Springs
Standard Oil Co.	6	3	11	Johnson 3	Santa Fe Springs
Standard Oil Co.	1	3	12	Watson 1	Santa Fe Springs
Joe B. Turman Syn. No. 2	12	3	12	2	Santa Fe Springs
Union Oil Co.	6	3	11	Bell 18	Santa Fe Springs
Union Oil Co.	6	3	11	Bell 19	Santa Fe Springs
Union Oil Co.	6	3	11	Bell 23	Santa Fe Springs
Union Oil Co.	6	3	11	Bell 24	Santa Fe Springs
Union Oil Co.	6	3	11	Alexander 5	Santa Fe Springs
Union Oil Co.	6	3	11	Alexander 8	Santa Fe Springs
Union Oil Co.	8	3	11	Meyer 16	Santa Fe Springs
Union Oil Co.	6	3	11	Alexander 6	Santa Fe Springs
Union Oil Co.	5	3	11	Farwell 3	Santa Fe Springs
Union Oil Co.	31	2	11	Bell 20	Santa Fe Springs
Universal Cons. Oil Co.	5	3	11	2	Santa Fe Springs
C. C. M. O. Co.	15	4	14	Torrance 4	Torrance
General Pet. Corp.	8	4	14	Carson 2	Torrance
Hub Oil Co.	15	4	14	Smith 1	Torrance
Petroleum Midway Co., Ltd.	8	4	14	Craven 1	Torrance
Shell Co.	9	4	14	Torrance 1	Torrance
Fresno Petroleum Co.	3	4	13	2	
Shell Co.	11	5	12	Bryant 1	
ORANGE COUNTY:					
A. B. C. Syn.	35	5	11	2	Huntington Beach
Central Oil Co. of L. A.	2	6	11	Community 2	Huntington Beach
Culver Oil Co.	2	6	11	1	Huntington Beach
George F. Getty	2	6	11	1	Huntington Beach
Holly Development Co.	2	6	11	Turley 3	Huntington Beach
Jameson Pet. Corp.	2	6	11	Block B-1	Huntington Beach
Milev Keck Oil Co.	35	5	11	27	Huntington Beach
M. H. Mosier Special	2	6	11	Porter 3	Huntington Beach
Shell Co. (U. D.)	34	5	11	Ashton 6	Huntington Beach
Standard Oil Co.	35	5	11	Hunt. G. 2	Huntington Beach
Standard Oil Co.	3	6	11	Hunt. B. 19	Huntington Beach
Standard Oil Co.	34	5	11	Hunt. B. 18	Huntington Beach
Union Oil Co.	34	5	11	Brooks 8	Huntington Beach
Union Oil Co.	35	5	11	Hill Com. 2	Huntington Beach
United States Oil Corp.	2	6	11	2-A	Huntington Beach
White Behr Pet. Syn.	2	6	11	Jackie Coogan 3	Huntington Beach
Union Oil Co.	29	3	9	Morse 4	Richfield
Union Oil Co.	29	3	9	Chapman 17	Richfield
Union Oil Co.	29	3	9	Chapman 24	Richfield
SAN BERNARDINO COUNTY:					
J. C. Marquardt	6	1	6	1	
SONOMA COUNTY:					
Beach & Landini	4	9	9	1	
VENTURA COUNTY:					
Dr. J. Von-Gal-Scaleh		2	21	1	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	2	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	3	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	4	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	5	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	6	Conejo
Dr. J. Von-Gal-Scaleh	4	1	20	7	Conejo
Hopper Canyon Oil Co.	3	4	19	1	Sespe
General Petroleum Corp.	28	3	23	Barnard 5	Ventura
Shell Co.	23	3	23	Hartman 2	Ventura

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff containing much information that will add to the permanent value of the Monthly Chapter are included in each number of 'Mining in California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

PRIMARY AND SECONDARY GOLD CONCENTRATIONS.

By CHAS. S. HALEY.

Concentrations of placer gold may generally be divided into two classes—those that are original and those that result as a secondary concentration of original ones. Under the first head we have primary stream bed erosion. A stream that is wearing down to its basal plane through a mountain range will in the course of many thousand years concentrate and segregate material from pockets and seams, as well as the larger ledges, extending through an enormous mass of ground. Many billions of tons of material may be sorted over by aerial and aqueous action and the residue thereof amounting to anywhere from 2 to 50 per cent of selected portions of the mass will be concentrated in the narrow gorge of the stream.

In the course of this concentration the most of the soluble constituents of the rock mass are removed. Pyrites, galena, and other sulphides are broken down and dissolved by the descending surface waters. Gold associated with these sulphides, being insoluble, simply descends by gravity to the lowest portion of the trough of the channel, in many cases taking ages of time to reach the bottom level. This solvent action is largely assisted by intensive frost conditions and the subsequent heat of the sun. The most insoluble constituents of the rock are clay and quartz, and as a rule these two will be found represented in all types of gravel.

Another type of primary concentration is that due to the erosion of a dike in place. Most intrusive dikes upon cooling have been cracked and the cracks have filled with stringers and cross veins running in all directions. If the magma beneath has been gold-bearing, these stringers often carry gold in considerable quantity. As the whole dike mass is planed off by atmospheric and water action, regardless of any one particular stream channel, a concentration will often occur on flats and plateaus which are not far removed from and often directly represent the original source of, the concentrated material. At Fresno, in the United States of Colombia, the writer has seen concentration of this sort from stringers in granite. The gravel consisted of about five feet of sub-angular soft granitic material and sand. Underneath these, torrential rains prevalent in the tropics had softened the granite for

a depth of from eight to ten feet. As a result, in order to recover any of the gold, it was necessary to sluice off the entire bed rock until undecomposed material was reached.

In California one of the best examples of primary concentration is in Holcomb Valley in San Bernardino County. Here a belt of mineralized porphyry extending in an easterly and westerly direction through Gold Mountain has been washed and concentrated along the sides of a comparatively shallow and wide basin.

A third type of primary concentration is exhibited in Alaska in the vast terminal moraines of the Yukon River basin. The gravel as a whole is very spotted and irregular in gold content and is not commercially profitable.

We now come to secondary concentrations, which probably represent the types of gravel commercially exploited in most of the placer mining districts of the present day. In the Sierras of California the system of Cretaceous rivers, which originally concentrated the gold from the metamorphic rocks thrown up by the Sierra uplift, have been crossed and recrossed at right angles by the present Quaternary system of drainage. As a result of this condition, the fabulously rich placers of the early days of California were formed. A single Quaternary stream in a bed not over fifty feet in width in many cases represented the concentration of half a mile of Cretaceous stream bed. Often gravel carrying this gold had been disintegrated and worn by attrition so much that only two or three feet of material needed to be worked in order to obtain the product of thousands of billions of tons of country rock, which had been concentrated and reconcentrated for thousands and even millions of years.

In Colombia, in Venezuela, the Guianas, and also in Ecuador, Peru and Bolivia, to a lesser degree these same conditions of secondary concentration have existed, but for some reason the primary concentrations seem to have produced the greater proportion of the placer gold that has been won from these countries. From the writer's observation, a reason for this is that the Cretaceous and Tertiary channels which have been concentrated by Quaternary streams in a manner analogous to California, have generally had their drainage through territory which was not auriferous.

The transportation and deposition of placer gold are governed by laws which at first glance seem rather complicated, but in analysis of these principles we find that they are quite simple. Streams that are heavily loaded with sand and mud will naturally have greater transporting power than the streams that are clear, their velocity depending largely upon their grade and cross section, and as these two elements vary greatly at short distances in all mountain streams, it is natural that the amount of gold that the stream is capable of carrying at the bottom of its current will vary greatly, causing more or less irregular distribution. Often in the case of streams of intermittent flow of varying magnitude caused by changing conditions, there will be recurrent stratas of gravel, which contain alternate barren areas and concentrations of gold. During the volcanic period this condition was largely emphasized in the Sierras by the frequent showers of ash, mud and detrital material, which at frequent intervals blocked and choked the streams, causing them to abandon and resume certain definite courses at irregular intervals.

As a rule, on the short turn of a river where the bed rock is sloping out toward a gentle curve and where the force of a current is lessened, we will find the greater concentrations of gold; conversely, on the long turns where the outside portion of the current moving at greater velocity has cut into bed rock, we do not find any great concentrations of gold because conditions have not been favorable for its lodging.

Where a rib of hard bed rock crosses a stream, causing a change in its grade, gold does not generally lodge on the upstream side. The force of the current will drag it over the crest of the ridge and deposit it on the downstream slope. Pot holes in rivers that have any considerable grade, as a rule are absolutely barren. Small crevices, with their upper ends pointing upstream, if they run transverse to the direction of the current, will form natural riffles for heavy gold. As a rule, heavy gold does not travel very far from its source. Fine gold travels very readily. This is very clearly evidenced on the American River in California, especially on the middle fork. For many years the short turns and bars formed near the flood-line of the river have been worked and reworked by rockers year after year. The same condition existed at Posepny in Hungary, and notably so on the Snake River in Idaho.

The concentration varies inversely as the distance from the source of the gold, whether primary or secondary. A river system is constantly working toward a grade or basal plane, which is continually being lowered. This tends to deposit values in fine gold lower and lower down the river. A case in point is noted in the deposition of the famous dredge placers of Oroville. Here the bed rock, however, is mostly tuffaceous, and it is quite possible that underneath this bed rock courses of the old Cretaceous rivers at great depth contained richer gravels than those that have been worked above. The difficulties in the way of prospecting and operating this material are such that it is extremely doubtful if it will ever be a commercial proposition to work. Prospecting an area like this is too much like operating a punch board—the amount of money put in is apt to be considerably more than the result is worth.

In general, it may be said that coarse gold as a rule is associated with gravel that contains the heavier constituents of the original rock; whereas fine gold is often and even generally associated with sand, clay, and light material. A case in point was noted by the writer on Portage Creek on the upper reaches of the Little Delta River in Alaska. Portage Creek drains the area of glacial moraines in the basin of the upper Tanana for an area of perhaps 50 square miles. There is no bed rock visible and the stream basins are all in gravel. At the bottom of the Portage Creek drainage there is a streak about six inches in depth lying on what may be termed "an original gravel bed rock," which carries a small amount of heavy gold. Above this streak there are four or five feet of light sand and pebbles. One or two fine colors to the pan is the average run of the upper gravel.

SECRETARY'S OFFICE.

W. W. THAYER, Secretary.

The California State Mining Bureau was created April 16, 1880, by legislative act. In March, 1893, the original act was repealed and an amended act approved and passed by the legislative body. Again on June 16, 1913, a new Mining Bureau Act was approved which became effective August 10, 1913, repealing all former acts, and forming the basic law under which the Bureau now functions.

It is doubtless true that both the mining and lay public have not in the past always recognized the part played by the Bureau in the development of the state's mineral resources. Innumerable inquiries regarding them, originating within and without its borders and in foreign countries, have been answered with ultimate results reflected by a consistent growth in the value of the state's mineral output since the records of production were first compiled by the Bureau in 1887.

It is believed that a better understanding of the economic position occupied by the Bureau will be imparted to the public, whose funds support it, by embodying in the Monthly Chapter a review of the executive activities.

The responsibility for the coördination of effort of each department, to the end that the utmost efficiency may be maintained with the limited and variable appropriations accorded the Bureau by successive legislatures, rests upon the office of Secretary.

Activities referable to that office, such as reports of new maps and publications issued, amount of mail handled, changes and enlargements in offices, changes in personnel of the staff, property and equipment, financial statements, etc., are therefore included herein.

New Publications.

During the month the following Bureau Publications have been made available for distribution:

Summary of Operations, California Oil Fields, October, 1922, Vol. 8, No. 4.

Mining in California, October, 1922, Vol. 18, No. 10.

Distribution of Publications.

The Bureau's publications are constantly in demand, requests for copies coming from all over the United States and foreign countries.

Publications were distributed during the month as follows:

Publications	Number distributed
Report XIV, State Mineralogist -----	2
Report XV, State Mineralogist -----	5
Report XVII, State Mineralogist -----	6
Mines and Mineral Resources of Colusa, etc. -----	1
Mines and Mineral Resources of Del Norte, etc. -----	1
Mines and Mineral Resources of Fresno, etc. -----	6
Mines and Mineral Resources of Imperial, etc. -----	2
Mines and Mineral Resources of Alpine, etc. -----	6
Mines and Mineral Resources of Butte, etc. -----	2
Mines and Mineral Resources of El Dorado, etc. -----	1
Mines and Mineral Resources of Los Angeles, etc. -----	4
Mines and Mineral Resources of Monterey -----	1

Publications	Number distributed
Mines and Mineral Resources of San Bernardino, etc. -----	2
Mines and Mineral Resources of Nevada County -----	1
Mines and Mineral Resources of Plumas County -----	1
Mines and Mineral Resources of Sierra County -----	1
Bulletin No. 6, California Gold Mill Practices -----	2
Bulletin No. 37, Gems, Jewelers' Materials, Ornamental Stones of California	11
Bulletin No. 50, Copper Resources of California (Revised) -----	0
Bulletin No. 72, Geologic Formations of California -----	22
Bulletin No. 75, United States and California Mining Laws -----	10
Bulletin No. 76, Manganese and Chromium in California -----	1
Bulletin No. 78, Quicksilver Resources of California -----	5
Bulletin No. 85, Platinum Resources of California -----	6
Bulletin No. 89, Petroleum Resources of California, with special reference to unproved areas -----	61
Bulletin No. 90, California Mineral Production for 1920, with County Maps	50
Mining in California (Monthly), Vol. 18, No. 10, October, 1922 -----	3000
Mining in California (Monthly), Vol. 18, No. 9, September, 1922 -----	50
Summary of Operations, California Oil Fields (Monthly), Vol. 8, No. 3, September, 1922 -----	3000
County Maps and Registers of Mines -----	6
Copper Deposits Map -----	2
Inyo County Geological Map -----	6
Tuolumne County Mineral Map -----	2
Geological Map of California, mounted -----	15
Lake County Map -----	2
Oil Field Maps -----	470
Map accompanying Bulletin No. 89 -----	38

Mails and Files.

The Bureau maintains in addition to its correspondence file a mine report file which includes reports on some 7500 mines and mineral properties in California. Also there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the month 768 letters were received and answered. They are practically all requests for information and the inquiries cover all phases of prospecting, mining and developing mineral deposits, reduction of crude minerals and marketing of refined products.

Drafting.

The Bureau maintains an up-to-date drafting department, where topographic and geological maps, tracings, oil well logs, and oil field maps are prepared.

DIVISION OF MINERALS AND STATISTICS.

STATISTICS, MUSEUM, LABORATORY.

WALTER W. BRADLEY, Statistician and Curator.

STATISTICS.

Estimate of 1922 Output.

The total value of the mineral production of California for the year 1922, just closed, is conservatively estimated to have been approximately \$257,351,690. This is, in part, detailed in the tabulation below; but, as there are more than fifty mineral substances on California's commercial list, it is impractical at this early date to obtain definite figures on other than the more important items. The blank report forms have been mailed out to the operators in all mineral lines, and the date of publication of the final and complete report will depend upon the promptness of their replies. The State Mining Bureau urges the hearty cooperation of all concerned, to the end that the results may be made known early.

This estimated total of \$257,351,690 is a decrease of \$10,805,782 from the 1921 production, due mainly to lower prices prevailing for crude petroleum, and an apparent decrease of nearly a million dollars in the gold yield. Preliminary reports indicate a record yield of approximately 139,000,000 barrels of petroleum; but, as production was considerably in excess of consumption, the prices for all grades dropped accordingly. This resulted in lowering the average price, although the increased yield was of the higher-gravity oils and especially in the later part of the year. We have estimated an average value, at the well, of \$1.60 per barrel for the first six months of 1922, and \$1.21 per barrel, the second half; the amounts being 61,000,000 barrels and 78,000,000 barrels, respectively, for the two periods. This gives an average of \$1.375 per barrel for 1922 as against \$1.804 per barrel in 1921. This results in a net decrease of slightly over \$12,000,000 in total value.

Though reports from the gold mining districts have, for the most part, been indicative of renewed interest and renewing operations, receipts of bullion at the mint and smelters show a decrease for the year. This was in part due to the Argonaut mine fire, and to a slight decrease in dredge yield. Silver, mainly from the Randsburg district as in 1921, showed a small decrease from the high point of the preceding year. Copper shows an increase to nearly double the 1921 figure, owing to the resumption of shipments by the Walker mine in Plumas County and the continuity of operations by its neighbor, the Engels group. Lead and zinc increased materially, both in quantity and value; as did also quicksilver in a lesser degree.

Magnesite shipments increased about 25 per cent, owing to improvement in the demand for plastic purposes. As the demand for building materials was active during 1922, the structural group (brick, cement, building stone, crushed rock, etc.) showed some increase in value over 1921. There were no notable changes in the general status of the miscellaneous "industrial" group; nor among the salines, except borax. The last-named recovered, in part, from the slump of 1921, and the present market is reported favorable for a continuation of activity.

The estimated quantities and values for 1922 are tabulated as follows:

\$14,900,000	gold.
3,200,000	(3,200,000 fine oz.) silver.
3,035,100	(22,650,000 lb.) copper.
356,250	(6,250,000 lb.) lead.
206,340	(3,620,000 lb.) zinc.
217,000	(3,500 flasks) quicksilver.
58,500	(650 fine oz.) platinum.
191,000,000	(139,000,000 bbl.) petroleum.
5,250,000	(75,000,000 M. cu. ft.) natural gas.
629,000	(59,100 tons) magnesite.
33,000,000	brick, cement, building stone, crushed rock, etc.
2,750,000	miscellaneous "industrial" minerals.
2,750,000	salines (including borax, potash, salt, soda, etc.).

\$257,351,690 Total value.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections located in North America; and contains not only one or more samples of most of the known minerals found in California, but many specimens from other states and foreign countries as well.

Aside from those visiting it for its purely educational features, the Museum daily attracts scores of tourists and travelers, and furnishes visual evidence of the well-nigh unlimited mineral resources of California. During the past 30 days a total of 527 visitors signed their names to the Museum register, and in addition there are many others daily who fail to take note of our request for their signatures. It is interesting to note how widely spread are the home localities of these visitors. In addition to nearly every county in California, there were thirty states, Alaska and Hawaii represented, as well as 15 foreign countries. Outside of California, Nevada led with 18 names; followed by Canada and Alaska, 15 each; Washington, 14; Oregon, 13; New York, 12; Ohio, 11; and Alabama, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Texas, Wisconsin, Wyoming, each showing from one to eight names. The following foreign countries, besides several provinces of Canada (including Alberta, British Columbia, Manitoba, Quebec, Saskatchewan and Yukon), are represented: Australia, Belgium, Costa Rica, Denmark, England, France, Germany, Honduras, Hungary, India, Japan, Java, Russia, San Salvador, South Africa.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection. The Bureau supplies a set of forty typical minerals and ores, appropriately labeled, for study purposes to any public school in the state upon request.

Among the specimens received recently, and catalogued for the Museum, are the following:

19750. *Dolomite*, high grade. From San Benito County, by C. L. Votaw, San Francisco.

19751. *Chrysotile Asbestos* (hydrrous magnesium silicate, fibrous serpentine). From Meikle Mine, on Coffee Creek, 2 miles north of Carrville, Trinity County, Cal., by Geo. M. Nelson, San Francisco.

19753. *Mica* (Muscovite, aluminum-potassium orthosilicate). From Peteca, Rio Arriba County, New Mexico, by Geo. M. Nelson, San Francisco.

19754. *Quartz* (silicon dioxide). Crystal. From 88' level stope, Bunker Hill Mine, Amador City Amador County, Cal.

19755 to 19761, Inc. *Tetrahedrite* (copper-antimony sulphide approaching Tennantite, on account of high arsenic content. Fine, large crystals; *Quartz* (silicon dioxide, crystals with *Chalcopyrite* (copper-iron sulphide); *Chalcopyrite* (copper-iron sulphide) 2 Fcs. Crystals; Pyrite, Chalcopyrite, Quartz, and Dolomite, showing successive deposition in order named; *Bornite* (copper-iron sulphide); *Galena* (lead sulphide) silver-bearing; *Pyrite* (iron disulphide, crystals, with Dolomite). From Morococha Mine, of Cerro de Pasco Mining Co., Cerro de Pasco, Peru, by Thomas A. Gill, Grass Valley, Cal.

19762. *Carnotite* (hydrous potassium, uranium, vanadium oxide). Massive. An unusually fine, high-grade specimen. From Copper Prince Mine, Roc Creek, Montrose Co., Colorado, by Ernest Schernikow, San Francisco.

19763. *Topaz* (aluminum fluo-silicate). From near Ramona, San Diego County, Cal., by Ernest Schernikow, San Francisco.

19764. *Copper, native*. From Arizona, by Ernest Schernikow, San Francisco.

19766 to 19780 Inc. *Lignite Coal*. Vein ranges from 2' to 11' thick between clay beds. Stated to give good results as powdered fuel; *No. 10 Clay*. White-burning; used in terra cotta bodies, face brick, garden terra cotta, flue lining etc.; "Red Bone" *Clay*. A 'bastard fire-clay' somewhat iron-stained, but quite refractory. Used in 'saggers' (clay pans in which potters burn wares to protect them from direct flames in kilns), also mixed with other clays in making sewer pipe; "Pink Mottle *Clay*" red-burning. Used for sewer pipe, roofing tile, hollow tile, and in mixes of vitreous brick, paving, face and rug brick, et al.; "E 101 China *Clay*." A fine-grained china clay, is obtained by washing, suitable for sanitary and porcelain wares. Also used as component of stoneware bodies, art pottery and novelty wares; "Yellow Owl Cut" *Clay*. Buff or red burning. Suitable for face or rug brick mixtures, hollow tile, roofing tile etc.; "Select West Blue" *Clay*. Cream or buff burning. Used for face brick, rug brick, terra cotta, ladle brick, roofing and hollow tile, etc.; "Red Mottle" *Clay*. Red-burning. For roofing and hollow tile, etc.; "Main Tunnel" *Fire Clay*. Refractory, sandy; used for fire brick, locomotive blocks and refractories; "SH4 Ball *Clay*." Very plastic, white-burning. Used in chinaware and porcelain mixes, china, insulators, etc.; "SH3" *Clay*. White-burning. Suitable for terra cotta, faience tile body, face brick garden pottery, etc.; "Extra Select Main Tunnel" *Clay*. A refractory fire-clay. Used for high-grade fire brick, also saggers, face brick, etc.; "Hill Blue" *Clay*. One of most useful. Used for faience tile body, terra cotta, garden and art pottery, stoneware, face brick, etc.; "West Tunnel Blue" *Clay*. Used for sewer pipe, hollow tile, etc.; "Hard Bone" *Clay*. A highly-aluminous fire-clay. Used for high-grade and extremely refractory fire-brick. From Alberhill, Cal., by Alberhill Coal & Clay Co., Alberhill, Cal.

19781. *Placer Gold*. From Magalia, Butte County, Cal. by Highland Chief Mine, Carl A. Phelps, Manager, Magalia, Cal.

LABORATORY.

FRANK SANBORN, Petrologist.

During the thirty-day period covered by this report, 211 samples were received and determined.

A list of those of possible commercial value, judged from the sample submitted only, is appended.

The Bureau will supply the name and address of the party who sent in any of the samples listed, upon request, if the reference number is given.

- 15-1 Iceland spar.
- 15-2 Talc-schist.
- 15-3 Copper ore; some silver and gold present.
- 15-4 Quartz containing lead vanadate; some silver present
- 15-5 Clay; alumina content fairly high.
- 15-6 Limonite; (paint pigment).
- 15-7 Gold-silver ore; contains pyrite and galena.
- 15-8 Quartz crystal.
- 15-9 Gypsum.
- 15-10 Silicified clay; burns white.
- 15-11 Lazulite.
- 15-12 Magnesite.
- 15-13 Massive garnet.
- 15-14 Highly kaolinized rock; (white-burning clay).

LIBRARY.

E. COONEY, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received during the month, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the state are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey:

- Bulletin No. 708. High Grade Clays of the Eastern United States, with Notes on Some Western Clays. By H. Ries, W. S. Bayley and others.
- Bulletin No. 709-N. Primary Traverse in South Carolina 1917-1919. By C. H. Birdseye, Chief Topographic Engineer.
- Bulletin No. 709-O. Triangulation in New Mexico and Texas, 1915-1917. By C. H. Birdseye, Chief Topographic Engineer.
- Bulletin No. 109-P. Triangulation in Wyoming and Colorado, 1916-1919. By C. H. Birdseye, Chief Topographic Engineer.
- Bulletin No. 709-Q. Triangulation and Primary Traverse in Texas, 1916-1920. By C. H. Birdseye, Chief Topographic Engineer.
- Bulletin No. 709-R. Triangulation and Primary Traverse in North Carolina. By C. H. Birdseye, Chief Topographic Engineer.
- Bulletin No. 730-D. Physiographic Provinces and Sections in Western Oklahoma and Adjacent Parts of Texas. By Nevin M. Fenneman.
- Bulletin No. 733. Geology of the York Tin Deposits, Alaska. By Edward Steidtmann and S. H. Cathcart.
- Bulletin No. 735-G. General Features of the Magnetite Ores of Western North Carolina and Eastern Tennessee. By W. S. Bayley.
- Bulletin No. 735-H. Peridotite Dikes in Scott County, Arkansas. By Hugh D. Miser and Clarence S. Ross.
- Bulletin No. 736-G. The Brooks, Steen, and Grand Saline Salt Domes Smith and Van Zandt counties, Texas. By Sidney Powers and Oliver B. Hopkins.
- Bulletin No. 742. Chromite of Kenai Peninsula, Alaska. By A. C. Gill.
- Bulletin No. 739-D. The Occurrence of Metalliferous Deposits in the Yukon and Kuskokwim Regions, Alaska. By J. B. Merite, Jr.

Mineral Resources:

- Gold, Silver, Copper and Lead in South Dakota and Wyoming in 1921. By C. W. Henderson.
- Manufactured Gas and By-Products in 1920. By R. S. McBride.
- Sulphur and Pyrites in 1921. By H. A. C. Jenison and H. M. Meyer.
- Cement in 1921. By Belle W. Bagley.
- Sand and Gravel in 1921. By L. M. Beach.
- Lime in 1921. By G. F. Loughlin and A. T. Coons.
- Gold, Silver, Copper, Lead and Zinc in Arizona in 1921. By V. C. Heikes.
- Water Supply Paper 473. Surface Water Supply of the United States, 1918. Part III—Ohio River Basin. By Nathan C. Grover, Albert H. Horton and C. G. Paulsen.
- Water Supply Paper 507. Surface Water Supply of the United States, 1919-1920. Part VII—Lower Mississippi River Basin. By Nathan C. Grover, C.H.E., Robert Follansbee and R. C. Rice, D.E.
- Professional Paper 124. The Inorganic Constituents of Marine Invertebrates. By Frank Wigglesworth Clarke and Walter Calhoun Wheeler.
- Professional Paper 131-C. The Shapes of Beach Pebbles. By Chester K. Wentworth.
- Professional Paper 131-E. Preliminary Report on Fossil Vertebrates of the San Pedro Valley, Arizona, with Descriptions of New Species of Rodentia and Lagomorpha. By James W. Gridley.

Technologic Papers of the Bureau of Standards:

- No. 216. Properties of Electrical Insulating Materials of the Laminated Phenol-Methylene Type. By J. H. Deelinger, Physicist, and J. L. Preston, Physicist, B.S.
- No. 219. Effect of Temperature, Deformation, and Rate of Loading on the Tensile Properties of Low-Carbon Steel Below the Thermal Critical Range. By H. J. French, Physicist, B.S.
- No. 221. Magnetic Susceptibility and Iron Content of Cast Red Brass. By L. H. Marchall, Research Associate, and R. L. Sanford, Physicist, B.S.
- No. 446. Spectrophotoelectrical Sensitivity of Argentite. By W. W. Coblenz, Physicist, B.S.
- No. 448. Decarburization of Ferrochromium by Hydrogen. By Louis Jordan, Chemist, and F. E. Swindells, Assistant Chemist, B.S.:

U. S. Bureau of Mines Reports of Investigations :

- Serial No. 2410. Contraction and Shrinkage of Nonferrous Alloys as Related to Casting Practice. By Robert J. Anderson, Metallurgist, B.M.
- Serial No. 2411. Arc Regulation in Electric Furnaces and Pilot Light Control. By C. E. Sims, Electrometallurgist, Northwest Experiment Station, U.S.B.M., in Cooperation with University of Washington.
- Serial No. 2412. Comparative Steaming Tests of Nenana Lignite and Matanuska Bituminous Coals. By John A. Davis, Superintendent, and Paul Hopkins, Chemist, Alaska Experiment Station, U.S.B.M.
- Serial No. 2413. Bureau of Mines Investigates Gold in Oil Shales and Its Possible Recovery. By Thomas Varley, Superintendent, Intermountain Station, U.S.B.M.
- Serial No. 2414. Explosives Used in September, 1922. By W. W. Adams, Statistician, U.S.B.M.
- Serial No. 2415. Distillation Gases Yielded by Trent Amalgams and Ethylene Found Therein as a Source of Alcohol. By J. D. Davis, Research Chemist, Pittsburgh Experiment Station, U.S.B.M.
- Serial No. 2416. Properties of Typical Crude Oils From the Producing Fields of Southern Louisiana and Southern Texas. By N. A. C. Smith, Petroleum Chemist, B.M., A. D. Bauer, Assistant Petroleum Chemist, B.M., and N. F. LeJeune, Assistant Chemist, B.M.
- Serial No. 2417. The Production of Carbon-Black From Natural Gas by the High Voltage Arc. By J. J. Jakowsky, Asst. Ref. Engineer, Pittsburgh Experiment Station, U.S.B.M.
- Serial No. 2418. Fatalities at Coal Mines in October, 1922. By W. W. Adams, Statistician, B.M.
- Bulletin No. 167. Coal Dust Explosion Tests in the Experimental Mine, 1913 to 1918, Inclusive. By George S. Rice, L. M. Jones, W. L. Egy and H. P. Greenwald.
- Technical Paper No. 318. Coke Oven Accidents in the United States During the Calendar Year 1921. By William W. Adams.
- Technical Paper No. 308. Analyses of Kentucky Coals.
- Technical Paper No. 265. Mesothorium. By Herman Schlundt.
- Twelfth Annual Report of the Director of the Bureau of Mines, 1922.
- Annual Report of the Director of the Mint for 1922.
- Annual Report of the U. S. National Museum, 1922.
- U. S. Department of Agriculture. Soil Survey of Nicholas County, West Virginia. By S. W. Phillips.
- Kentucky Geological Survey Series VI, Vol. VII—Mississippian Series of Eastern Kentucky. By Charles Butts.
- North Carolina Geological and Economic Survey—Economic Paper No. 53—Water Power Survey of Surry and Wilkes Counties. By Thorndike Saville.
- Eleventh Biennial Report of the State Geologist of Wyoming.
- Canada Department of Mines, Geological Survey, Summary Report 1921, Parts A, D, E.
- Memoir 130. Geology and Mineral Deposits of the Bridge River Map-area, British Columbia. By W. S. McCann.
- Republic Argentina, Anales del Ministerio de Agricultura de la Nacion, Seccion Geologia, Mineralogia y Mineria Tomo XVI, No. 1. E. Nevado de Famatina, Dr. Guillermo Bodenbender.
- Boletin No. 5. Sumario.
- Boletin No. 31. Series B (Geologia) Informe Sobre Estudios Geologico Economicos En la Provincia de Catamarca. Por el Dr. Roberto Beder.
- Boletin No. 32. Series B (Geologia) La Cuenca de Marayes. Por el Dr. Juan Rasmuss.
- Secretaria de Industria Comercio y Trabajo Boletin Minero Organon del Departamento de Minas. Tomo XLII, Numero 6, June, 1922. Mexico.

Societies and Educational Institutions.

- Journal of the Mineralogical Society of America, November, 1922.
- Bulletin of the Institution of Mining and Metallurgy, November, 1922.
- The Philippine Journal of Science, November, 1922.
- Mining and Metallurgy, December, 1922.
- Proceedings of the Engineers' Society of Western Pennsylvania, October, 1922.
- Transactions and Proceedings of the Royal Society of South Australia, Vol. XLV.

The Journal of Geology, November and December, 1922.
 Economic Geology, December, 1922.
 Monthly Bulletin of the Canadian Institute of Mining and Metallurgy, January, 1923.
 The Geographical Review, January, 1923.
 The Mining Congress Journal, January, 1923.
 Bulletin of the American Petroleum Institute.

Maps.

U. S. G. S. Topographical Sheets:
 Chaney Ranch, Fresno County, Quadrangle.
 Tuft's Ranch, Fresno County, Quadrangle.
 Parks Bar Quadrangle.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

Architect and Engineer, San Francisco.
 Arizona Mining Journal, Phoenix, Arizona.
 Asbestos, Philadelphia, Pennsylvania.
 American Petroleum Institute, New York.
 Brick and Clay Record, Chicago.
 Chemical Engineering and Mining Review, London, England.
 Cement, Mill and Quarry, Chicago, Illinois.
 Engineering and Mining Journal-Press, New York.
 Financial Insurance News, Los Angeles, California.
 Hercules Mixer, Washington, Delaware.
 Journal of Electricity and Western Industry, San Francisco.
 Metallurgical and Chemical Engineering, New York.
 Mining and Oil Bulletin, Los Angeles.
 Mining and Engineering Record, Vancouver, B. C.
 Oildom, New York.
 Oil Weekly, Houston, Texas.
 Oil and Gas Journal, Tulsa, Oklahoma.
 Oil, Paint and Drug Reporter, New York.
 Oil Trade Journal, New York.
 Oil Age, Los Angeles.
 Oil News, Galesburg, Illinois.
 Petroleum Record, Los Angeles.
 Petroleum Refiner, Kansas City, Missouri.
 Petroleum Age, New York.
 Petroleum World, Los Angeles.
 Queensland Government Mining Journal, Brisbane, Australia.
 Rock Products, Chicago, Illinois.
 Southwest Builder and Contractor, Los Angeles.
 Stone, New York.
 Salt Lake Mining Review, Salt Lake City, Utah.
 Standard Oil Bulletin, San Francisco.
 Safety News, Industrial Accident Commission, San Francisco.
 The Record, Associated Oil Company, San Francisco.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
 Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
 Bakersfield Morning Echo, Bakersfield, Cal.
 Blythe Herald, Blythe, Cal.
 Bridgeport-Chronicle-Union, Bridgeport, Mono Co., Cal.
 California Oil World, Los Angeles, Cal.
 Colusa Daily Sun, Colusa, Cal.
 Daily Midway Driller, Taft, Cal.
 Del Norte Triplicate, Crescent City, Cal.

Exeter Sun, Exeter, Cal.
Georgetown Gazette, Georgetown, Cal.
Gateway Gazette, Beaumont, Cal.
Gilroy Gazette, Gilroy, Cal.
Goldfield News, Goldfield, Nevada.
Guerneville Times, Guerneville, Cal.
Humboldt Standard, Eureka, Cal.
Healdsburg Enterprise, Healdsburg, Cal.
Inyo Independent, Independence, Cal.
Inyo Register, Bishop, Cal.
Lake County Bee, Lakeport, Cal.
Mariposa Gazette, Mariposa, Cal.
Mining and Financial Record, Denver, Colo.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oroville Daily Register, Oroville, Cal.
Oatman Mining Press, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Petroleum Reporter, Etna Mills, Cal.
Plumas Independent, Quincy, Cal.
Plumas National Bulletin, Quincy, Cal.
Placer Herald, Auburn, Cal.
Sacramento Union, Sacramento, Cal.
San Diego News, San Diego, Cal.
Santa Barbara Daily News, Santa Barbara, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Siskiyou Standard, Fort Jones, Cal.
Stockton Record, Stockton, Cal.
Sunset Journal, Sunset District, San Francisco, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of consumers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

Sufficient publicity has not heretofore been given to this feature of the Bureau's work, but in 'Mining in California' a suitable medium is provided for current inquiries of this nature, and, therefore, written or verbal inquiries that come to the attention of the Bureau are summarized in each issue.

The name of the product wanted or offered, only, is published; the name of the owner of the deposit, or buyer, and other details being supplied upon request.

In writing, the reference number of the item should be given.

Mineral Products or Deposits for Sale.

- 12-1 Graphite deposit.
- 12-2 Large gold property; or will lease.
- 12-3 Mica; average size sheets 2" x 2½".
- 12-4 Clear quartz crystals.
- 12-5 Montmorillonite (rock soap); 500 feet to railroad.
- 12-6 Colemanite; five miles from Shoshone.
- 12-7 Fluorspar; can furnish large quantity.
- 12-8 Magnesite.
- 12-9 Manganese ore.
- 12-10 Strontianite.
- 12-11 Arsenical iron oxide; high in arsenic.
- 12-12 Potash feldspar (orthoclase).
- 12-13 Large deposit of arsenic.

Mineral Products or Deposits Wanted.

- 13-1 Arsenical ore; tonnage.
- 13-2 Gold mine; placer or quartz that can be developed on a rather large scale.
- 13-3 Bentonite (rock soap).
- 13-4 Earth colors; green, blue, yellow, orange, purple, etc.; tonnage.
- 13-5 Molybdenum; 85% MoS₂; 25 tons per month.
- 13-6 Beryl mineral (not gem quality), 25 tons or over per month.
- 13-7 Lithia ores; 100-ton lots. Amblygonite 8-9% LiO₂; Spodumene 6-7%; Lepidolite 4-5%.
- 13-8 Molybdenum; deposit or tonnage.
- 13-9 Manganese; deposit or tonnage.
- 13-10 Arsenic; deposit or tonnage.
- 13-11 Quicksilver; deposit or tonnage.
- 13-12 Bismuth; deposit or tonnage.
- 13-13 Tungsten; deposit or tonnage.
- 13-14 Lump pumice; 1" to 1½" lumps and up; tonnage.

EMPLOYMENT SERVICE.

Following close upon the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau contemplates registering technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of applicants for positions and 'positions open,' received by the Bureau during each 30-day period preceding the date of publication of the Monthly Chapter is carried in each issue.

Each notice is designated by a key number, and communications sent to the Bureau in reply to any notice will be forwarded to the proper party without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss.

Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

- 11-1 Assayer. Technical course completed. Age 29; single. References. Salary wanted \$125.
- 11-2 Manager or Superintendent. Reads, writes and speaks Spanish fluently. Age 42; married. References. Salary wanted \$300 minimum.
- 11-3 Junior Mining Engineer or Geologist. Technical graduate. Two years experience. Age 24; single. Reference. Salary wanted \$150 minimum.
- 11-4 Accounting—office work. Sixteen years experience as chief accountant and auditor. Age 57; single. References. Salary wanted \$150-\$175.

During the month one opening was brought to the attention of qualified applicants.

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-two years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield; Auburn, and Redding. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	-----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	-----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	-----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	-----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	-----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. By Henry G. Hanks	-----
**Part II, 1887, 222 pp., 36 illustrations. William Ireland, Jr.	-----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Ireland, Jr.	-----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Ireland, Jr.	-----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Ireland, Jr.	-----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Ireland, Jr.	-----
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Ireland, Jr.	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford	-----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford	-----
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	-----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper	.25
Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pp., paper	.50
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper	-----
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth	\$2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton:	
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper	.65
Same, including geological map of Inyo County	1.25
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.65

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper-----	\$0.50
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper-----	.65
Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper-----	.65
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:	
A general Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth-----	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper-----	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper-----	.50
Mines and Mineral Resources of Sierra County, 144 pp., paper-----	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California During 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth-----	1.75
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)-----	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, December, 1919-----	Free
January, February, March, April, May, June, July, **August, September, October, November, December, 1920-----	Free
January, February, March, April, May, June, **July, August, **September, **October, **November, December, 1921-----	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free

BULLETINS.

	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations-----	----
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations-----	----
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps-----	----
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)-----	----
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations-----	----
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations-----	.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 9. Mine Drainage, pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations-----	----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.	-----
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations.	-----
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale.	-----
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899.	-----
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations.	-----
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations.	-----
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps.	-----
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899.	-----
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet.	-----
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet.	-----
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps.	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps.	-----
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet.	-----
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps.	-----
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet.	-----
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903. 290 pp.	-----
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet.	-----
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps.	-----
**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet.	-----
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California.	-----
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps.	-----
Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kuntz. 1905, 168 pp., 54 illustrations.	.25

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map-----	-----
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet-----	-----
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps-----	-----
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps-----	-----
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907, 10 pp.-----	-----
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp.-----	\$0.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 48. Mineral Production of California for Twenty Years, 1906, by Charles G. Yale-----	-----
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp.-----	-----
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)-----	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker. 62 pp.-----	-----
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker. 1908. Tabulated sheet-----	-----
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet-----	-----
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by H. D. Walker. 78 pp.-----	-----
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps.-----	-----
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet-----	-----
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet-----	-----
**Bulletin No. 60. Mineral Production for 1909. County Maps and Mining Laws of California, by D. H. Walker. 94 pp.-----	-----
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet-----	-----
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps.-----	-----
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp.-----	-----
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp.-----	-----
**Bulletin No. 66. Mining Laws of the United States and California. 1914. 89 pp.-----	-----
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914. 226 pp.-----	-----
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp.-----	-----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]-----	----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp.-----	----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations-----	----
Bulletin No. 72. The Geologic Formations of California, with Reconnaissance Geologic Map, by James Perrin Smith. 1916, 47 pp.-----	\$0.25
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin. 278 pp., 26 illustrations-----	----
Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations-----	Free
**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper-----	----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper-----	.50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880—1917, by E. S. Boalich. 44 pp., paper-----	Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on metallurgy and ore-dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth-----	1.50
Bulletin No. 79. Magnesite in California. (unpublished)-----	----
Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)-----	----
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)-----	----
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth-----	----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper-----	Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth-----	----
Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper-----	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper-----	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper-----	----
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper-----	Free
Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leek, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth-----	\$1.25
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper-----	Free
Bulletin No. 91. Minerals of California, by Arthur S. Eakle. (in press)-----	----

PRELIMINARY REPORTS.

Asterisks (**) indicate publication is out of print.

	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp. -----	----
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper-----	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper--	Free
Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper-----	Free
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper -----	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper -----	----

MISCELLANEOUS PUBLICATIONS.

Asterisks (**) indicate publication is out of print.

	Price
**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp. -----	
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp-----	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.-----	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp. -----	----
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. -----	----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. -----	----
**Catalogue of West North American and many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 -----	----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper -----	----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper-----	Free

MAPS.

Registers of Mines With Maps.

(**) indicates out of print.

Register of Mines, with Map, Amador County -----	\$0.25
Register of Mines, with Map, Butte County -----	.25
**Register of Mines, with Map, Calaveras County -----	
**Register of Mines, with Map, El Dorado County -----	
**Register of Mines, with Map, Inyo County -----	
**Register of Mines, with Map, Kern County -----	
**Register of Mines, with Map, Lake County -----	
**Register of Mines, with Map, Mariposa County -----	
**Register of Mines, with Map, Nevada County -----	
**Register of Mines, with Map, Placer County -----	
**Register of Mines, with Map, Plumas County -----	
**Register of Mines, with Map, San Bernardino County -----	
**Register of Mines, with Map, San Diego County -----	
Register of Mines with Map, Santa Barbara County -----	.25
**Register of Mines, with Map, Shasta County -----	
**Register of Mines, with Map, Sierra County -----	
**Register of Mines, with Map, Siskiyou County -----	
**Register of Mines, with Map, Trinity County -----	
**Register of Mines, with Map, Tuolumne County -----	
Register of Mines, with Map, Yuba County -----	.25
Register of Oil Wells, with Map, Los Angeles City -----	

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

Price

Map of California, Showing Mineral Deposits (50 x 60 in.)—	
**Mounted -----	
**Unmounted -----	
Map of Forest Reserves in California—	
Mounted -----	\$0.50
**Unmounted -----	
**Mineral and Relief Map of California-----	
**Map of El Dorado County, Showing Boundaries, National Forests-----	
**Map of Madera County, Showing Boundaries, National Forests-----	
**Map of Placer County, Showing Boundaries, National Forests-----	
**Map of Shasta County, Showing Boundaries, National Forests-----	
**Map of Sierra County, Showing Boundaries, National Forests-----	
**Map of Siskiyou County, Showing Boundaries, National Forests-----	
**Map of Tuolumne County, Showing Boundaries, National Forests-----	
**Map of Mother Lode Region -----	
**Map of Desert Region of Southern California-----	
Map of Minaret District, Madera County-----	.20
Map of Copper Deposits in California-----	.05
**Map of Calaveras County -----	
Map of Plumas County -----	.25
**Map of Trinity County -----	
Map of Tuolumne County -----	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles-----	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin -----	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted-----	2.50

OIL FIELD MAPS.

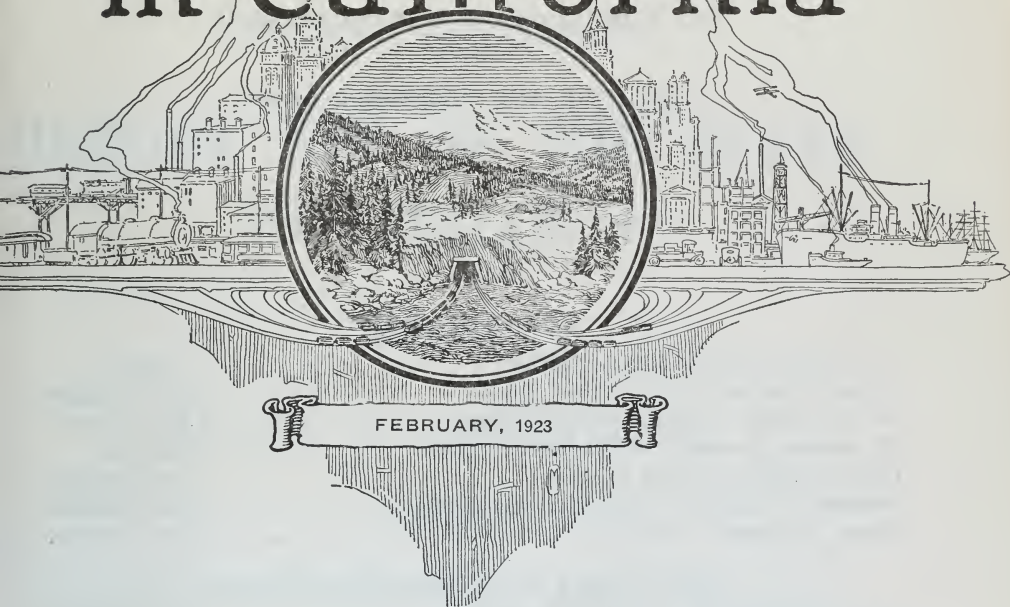
These maps are revised from time to time as development work advances and ownerships change.

	Price
Map No. 1—Sargent, Santa Clara County.....	\$0.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos.....	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc.....	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield.....	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello.....	.75
Map No. 6—Salt Lake, Los Angeles County.....	.75
Map No. 7—Sunset and San Emido and Kern County.....	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County.....	.75
Map No. 9—North Midway and McKittrick, Kern County.....	.75
Map No. 10—Belridge and McKittrick, Kern County.....	.75
Map No. 11—Lost Hills and North Belridge, Kern County.....	.75
Map No. 12—Devils Den, Kern County.....	.75
Map No. 13—Kern River, Kern County.....	.75
Map No. 14—Coalinga, Fresno County.....	.75
Map No. 15—Elk Hills, Kern County.....	.75
Map No. 16—Ventura-Ojai, Ventura County.....	.75
Map No. 17—Santa Paula-Sespe Oil Fields, Ventura County.....	.75
Map No. 18—Piru-Simi-Newhall Oil Fields.....	.75
Map No. 19—Arroyo Grande, San Luis Obispo County.....	.75
Map No. 20—Long Beach Oil Field.....	.75
Map No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties.....	.75
Map No. 22—Portion of District 3, Showing Oil Fields, Santa Barbara County.....	.75
Map No. 23—Portion of District 2, Showing Boundaries of Oil Fields, Ventura County.....	.75
Map No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties.....	.75
Map No. 25—Kern River Oil Field.....	.75
Map No. 26—Huntington Beach Oil Field.....	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the State may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the State. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

Mining in California



PUBLISHED MONTHLY BY
**CALIFORNIA STATE
MINING BUREAU**

FERRY BUILDING
SAN FRANCISCO

CONTENTS.

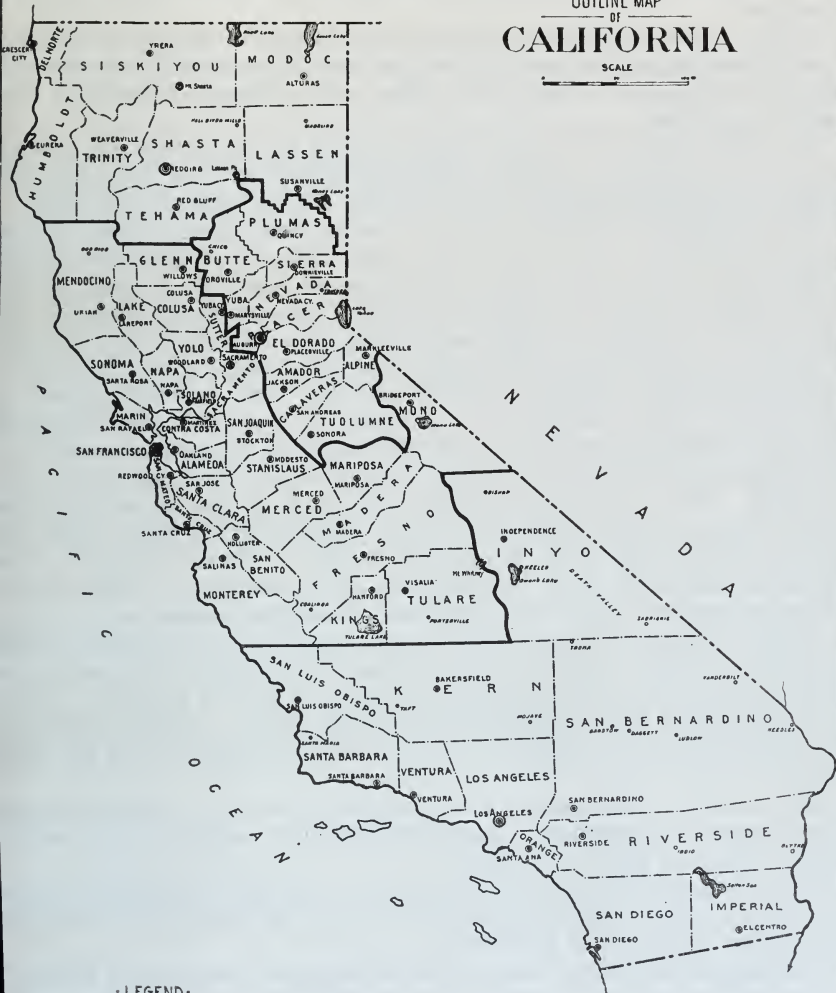
	Page
PREFACE	53
DISTRICT REPORTS OF MINING ENGINEERS.....	55
Redding Field Division.....	55
Auburn Field Division.....	59
San Francisco Field Division.....	60
Los Angeles Field Division.....	61
Oil Field Development Operations.....	65
SPECIAL ARTICLES	67
Mining Location on Stock-raising Lands.....	67
Limestone Deposits of McCloud River, Shasta County, and Their Possible Value for Cement Material.....	69
The Problem of Exploiting the Small Mine and Prospect.....	72
SECRETARY'S OFFICE	77
DEPARTMENT OF MINERALS AND STATISTICS.....	79
Statistics	79
Museum	79
Laboratory	79
LIBRARY	81
PRODUCERS AND CONSUMERS.....	86
Mineral Products or Deposits for Sale.....	86
Mineral Products or Deposits Wanted.....	86
EMPLOYMENT SERVICE	87
BUREAU PUBLICATIONS	I

CALIFORNIA STATE MINING BUREAU

O R E G O N

—
OUTLINE MAP
OF
CALIFORNIA

SCALE



• LEGEND •

- Mining Division Boundaries.
- Mining Division Offices.

M E X I C O

PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive forward step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922.

A monthly publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff are included. Mineral production reports formerly issued as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance are reported monthly. The assistance formerly given to producers and consumers by consultation or correspondence only, is also proffered through this medium.

While current activities of all descriptions will be reported in this Monthly Chapter, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added to that list in the future as they are completed.

The Monthly Chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful latent resources of the State of California.

'Mining in California' is sent without charge to those on the Bureau's exchange list and to all others who make written or verbal request.

Pages are numbered consecutively throughout the year, and an index to the complete reports will be included annually in the December number.

TO THE MINING PUBLIC.

The miner is by nature a pioneer and as such, the mining fraternity has evolved into a group whose thoughts have been governed by the pioneering spirit and whose individual activities have been largely independent.

This typical American spirit also dominated commercial and other industrial enterprises for many years, but during the last few decades the leaders of industry and commerce have learned that there are many advantages to be gained by cooperative associations that develop a closer relationship between man and man.

The miner, as a rule, still clings to the idea of independent action, but it is my belief that he can solve many of his problems and help relieve the industry, as a whole, of some of its burdens by working for the good of all through closer cooperation with every agency maintained for the benefit of the mineral industry. In California for the past forty-three years the State Mining Bureau so far as it has been able has rendered service to the large and small operator, the investor, and the prospector.

The service given by the State Mining Bureau is thoroughly discussed in the November 1922 issue of 'Mining in California' by Fletcher Hamilton, retiring State Mineralogist.

It is my belief that those in whose behalf the Mining Bureau functions have not always taken full advantage of the opportunity for cooperative effort, and it is my desire to assist in every possible way in bringing the Bureau into closer mutual relations with every individual interested in any phase of the development of our immense mineral resources. To that end constructive criticism of the State Mining Bureau's work is invited and specific suggestions, wherein a more economical and efficient plan can be devised for carrying on the functions of the Bureau, will be given full consideration.

The united efforts of the State Mining Bureau and those directly and indirectly affected by the condition of this basic industry in California, alone, can give to the mining industry that feeling of strength that will bring it the recognition it deserves from the commonwealth.

With this object in view, it will be my endeavor to cooperate with, and render every aid possible within the scope of the Bureau's activities to one and all.

LLOYD L. ROOT,
State Mineralogist.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each division working out from a local branch office.

This move brought the Bureau into close personal contact with operators, but did not materially shorten the time between the gathering of data in the field and their publication in the Report of the State Mineralogist at the end of an annual or biennial period.

Mining activities and development noted by district engineers in their respective fields are now embodied in monthly reports published in each issue of 'Mining in California,' thus making these data available within a maximum period of thirty days, and the Monthly Chapter as far as possible a compendium of current mining progress throughout the State.

The counties included in each field division and the location of the local offices are shown on the accompanying outline map of the State. (Frontispiece.)

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the State's oil fields is included under this heading.

REDDING FIELD DIVISION.

W. B. TUCKER, Mining Engineer.

Shasta County.

COPPER.

Akers Group of Mines, located in Secs. 6 and 7, T. 33 N., R. 5 W., 5 miles west of Kennett, in the Backbone mining district. Elevation 1000 feet. Holdings comprise fourteen claims, totaling approximately 280 acres, located along Squaw Creek, between the Mammoth and Balaklala mines and adjoining the Trinity Copper Company's property on the east. The development work on these claims is confined to five tunnels along an intrusion of quartz-augite-diorite, about 200 to 300 feet in width, with a general east and west trend, which occurs in the Balaklala rhyolite. The gossan croppings are prominent and can be followed for about 1000 feet. The ore occurs in small irregular lenticular ore bodies along irregular fissures, one of which trends north and south, with a dip of 60 degrees east, the other having a N. 40° W. trend. The ore is chiefly pyrite, with more or less chalcopyrite and occasional traces of bornite, and carries \$2 per ton in gold and silver. Developments comprise five tunnels from 100 to 300 feet in length with numerous crosscuts. The present work is confined to No. 3 tunnel, where a series of parallel north and south fractures and a N. 40° W. fracture are being drifted on. Some small lenses of ore have been exposed along these fractures varying in width from 2 inches to 2 feet, and from 10 to 15 feet in length. In this tunnel there is a drift 261 feet north on a north and south fracture, and one to the south 244 feet on a parallel fracture, and in this south drift the main N. 40° W. fissure was cut.

On the claims located on the south side of Squaw Creek there are two tunnels, which have lengths of 100 feet. In the lower tunnel, which is driven on a northwest fracture a small lens of ore 40 feet in length and about 2 feet in width has been developed. Samples taken from this orebody are reported to carry from 2 to 6 per cent copper. One man employed on development work. J. W. Akers of Kennett, owner.

Woodrow Wilson Mine, located in Sec. 4, T. 33 N., R. 2 W., $1\frac{3}{4}$ miles southwest of Ingot, in the North Cow Creek Mining District. Elevation 1800 feet. Owners are the *Triumvate Mining Company* of Ingot, H. M. Swift, president, J. H. Jones, secretary. The holdings consist of the following claims: Homestead Extension, Woodrow Wilson, Woodrow Wilson Extension, Woodrow Wilson No. 2, No. 3 and No. 4, approximately 160 acres, located on the East Copper belt, and adjoining the Afterthought Copper Company's property on the west. Two systems of veins have been developed, known as the Homestead and Woodrow Wilson lodes. The former occurs in a sheer zone in the rhyolite which lies south of the contact of the rhyolite and shales of the Pit formation, and has an easterly and westerly trend with a dip of 75 degrees to the north. Two shafts have been sunk on this vein to depths of 35 feet, developing 6 to 8 feet of quartz, in which occur irregular lenses of ore. The ore is of a different character from that developed in the other mines of this district, in that it carries high values in lead. The quartz contains galena, chalcopyrite, pyrite and sphalerite. Samples taken from the vein are reported to assay, copper 2.5 per cent, lead 17 per cent, zinc 3 per cent, gold and silver \$3 per ton.

The Woodrow Wilson lode lies close to the contact of rhyolite with black and gray shales, and strikes northeast and southwest, with a dip of 50 degrees to the northwest. The ore is similar to that of the Afterthought mine, being composed largely of pyrite, sphalerite, chalcopyrite and galena with local traces of bornite. Samples taken from No. 1 and No. 2 tunnel workings are reported to assay, copper 1 per cent, lead 6 per cent, zinc 13 per cent, gold and silver \$2 per ton. Developments on this lode consist of three tunnels; No. 1 tunnel is driven N. 30° E., 140 feet in the slate hanging wall, then 120 feet east to the contact, where some small lenses of ore were found. No. 2 tunnel is located 180 feet northwest and 70 feet below No. 1 tunnel, and is a crosscut driven 400 feet southwest in the slate to the contact, with a drift to the northeast 200 feet on the contact. The ore developed occurs on the contact in the rhyolite, and is quartz containing small lenses of ore. Owing to the fact that no crosscuts have been driven in the rhyolite in these workings, the possible extent of the orebodies are undetermined. No. 3 tunnel, which is located 650 feet west, and 100 feet below No. 2 tunnel, is a crosscut tunnel driven S. 70° E., 200 feet in the slate hanging wall towards the contact. It will require approximately 300 feet of additional drifting to cut the orebody developed in No. 2 tunnel workings. Only assessment work is being done on the property.

Uncle Sam Mine, one of the noted quartz mines of Shasta County, is located in Sees. 1 and 6, T. 33 N., R. 6 W., 6 miles west of Kennett, in the Backbone Mining District. Elevation 2300 feet. The present owners are *F. H. Dakin Company* of San Francisco, who control 140

acres of patented mineral ground. The property is now under lease and bond to the *American Zinc, Lead and Smelting Company* of St. Louis. Offices of the exploration department of this company are at 55 Congress street, Boston, Mass. The company also have under option the *Colma Copper Group* of claims, which are located in Sees. 3 and 6, T. 33 N., R. 6 W., and adjoin the Uncle Sam group on the north and east. The Colma Copper group of claims lie west and southwest of the Mammoth Mine, and cover the probable direct extensions of the ore bodies developed in the Mammoth Mine, along the so-called 'California fissure' or shear zone, which has a general trend of N. 80° E. The trend of the tabular ore deposition has been developed in the Mammoth Mine from the point of original exposure for a distance of over 4000 feet towards the Colma Copper Group boundaries. Therefore the logical point for further and deeper development of the California fissure would probably be on the Colma Copper territory. Evidently with this idea in view the present company is driving the main crosscut known as No. 5 level of Uncle Sam mine. This crosscut tunnel is driven N. 40° E., and cuts the Uncle Sam vein 1200 feet from the portal, and about 350 feet beyond this vein, cuts a parallel vein of quartz 3 feet in width, which is heavily mineralized with pyrite and chalcopyrite. The crosscut tunnel has been driven ahead 1300 feet, from the point where the Uncle Sam vein was cut, and the company proposes to continue driving ahead to intersect the Mammoth ore fissure.

The formation in which the Uncle Sam veins occur is Balaklala rhyolite which is cut by a dike of andesite porphyry. The greater values were found in the eastern portion of the mine, about this dike.

Two veins are developed in the Uncle Sam mine, which strike northwest and southeast and dip northeast, with a thickness of four feet. A new 10" x 12" Rand Compressor, driven by a 50-h.p. motor has been installed. Electric power is secured from the Pacific Gas and Electric Company. Eight men are employed. C. B. Nichols, superintendent.

Bibliography: State Mineralogist Reports X, p. 639, XI, pp. 47, 395, 398; XII, p. 258, XIII, p. 367, XIV, pp. 802-803.

The *United States Smelting, Refining and Mining Company*, which controls the Mammoth Smelter, Mammoth, Keystone Sutro and Balaklala mines, situated near Kennett, on the West Copper belt is reported to be planning to resume operations in the near future.

GOLD.

Index Group of Mines. Located in Sec. 6, T. 32 N., R. 6 W., one-half mile north of Oak Bottom, in the Stella Mining District. Elevation 1500 feet. Owners, I. F. Rice and A. Kaleel of Whiskeytown. Holdings consist of 12 claims located on a ridge north of Clear Creek.

A series of parallel quartz veins occur in alaskite porphyry intrusions in meta-andesite. The veins have a general east and west trend, with dips north. Widths vary from 2 inches to 6 feet. Developments consist of two tunnels, one 140 feet in length and the other 150 feet, and a number of shallow prospect holes and open cuts. There are three men employed.

Texas Consolidated Mine, located in the Old Diggins district, 9 miles north of Redding, in Sec. 33, T. 33 N., R. 5 W., is under lease to Harvey Sallee of Old Diggins. Several men are employed driving a crosscut on tunnel level No. 5 to pick up the vein, which was faulted on this level.

Siskiyou County.

Fairchild Mine, which is situated at the head of Long Gulch, west of Hawkinsville, has been taken under bond by T. W. Billings and associates of Oregon. It is reported that in recent development work on the property, a rich shoot of ore was encountered. The vein is said to have a width of 8 feet, and to carry high values.

The Rainbow Mine, located $1\frac{1}{2}$ miles northwest of Hawkinsville, is being developed by T. C. Quinn of Oakland. It is reported that after drifting 90 feet, a vein of quartz was developed that carries high values in gold.

PLACER MINING ACTIVITY.

It is reported that there will be increased activity in placer mining this spring near Cecilville, Oak Bar, Forks of the Salmon River, Sawyers' Bar and also on Elk Creek near Happy Camp. Due to abundant rains and heavy snowfall this winter the season's run for hydraulic mining should be somewhat more extended than previous years. Therefore, there should be a large output in placer gold from the county this season.

Trinity County.

Cabode Mine, which is situated in Donnelly Gulch, between Lewiston and Deadwood was recently leased by James Welsh and Charles Paulsen of Lewiston.

In prospecting and development work on the property a small vein of quartz has been developed which carries high values in gold. Samples taken from the ledge, which is from three to six inches wide, assayed from \$5,000 to \$6,000 per ton. About three tons of rich ore are on the dump awaiting shipment. The property has not been worked for many years.

Union Hill Hydraulic Mine, is located in Sec. 6, T. 32 N., R. 9 W., one mile east of Douglas City, between Weaver Creek and Trinity River, and contains 300 acres.

The property is under lease to T. R. Arbuckle of Weaverville, who during the past year repaired the ditch lines and now has two 7-inch giants in operation under a head of 450 feet.

Water for hydraulic purposes is secured from Grass Valley, and the East Fork of Weaver Creeks, through ditches, flumes, pipes and tunnels that are said to be 20 miles in length. Capacity 5000 inches.

The property was last operated by the *Trinity Consolidated Hydraulic Mining Company* in 1913 and 1914. The gravels of the Union Hill mine are uncemented and lie horizontally on one of the recent terraces about 175 feet above the Trinity River. The depth of gravel is from 50 to 150 feet and is composed chiefly of red clay, sandy clay, bluish gray gravel lying on mica schist bedrock. Nearly

all the values are found in the blue gravel at the bottom on the mica schist bedrock. Seven men are employed.

Bibliography: U. S. G. S. Bulls. No. 430, pp. 51-56; No. 470, pp. 16-18; No. 540, pp. 18-19; State Mineralogist's Reports XIII, p. 465; XIV, p. 915.

The Dannenbrink Hydraulic Mine, located about 6 miles north of Junction City, at an elevation of 2000 feet, on Canyon Creek, in Sees. 12, 13 and 24, T. 34 N., R. 11 W., owned by C. Dannenbrink Estate, has recently been acquired by the *Pittsburg-Comstock Mining Company* of Virginia City, Nevada. The depth of gravel is from 30 to 100 feet with 10 feet of soil overburden with slate bedrock. The company is constructing a new ditch said to be 10 miles in length. Twenty to forty men are employed. T. M. Gibson is superintendent.

Bibliography: State Mineralogist's Report XIII, p. 444.

The 7-cubic feet dredge of the *Lewiston Dredging Company*, which is located on the Martin ranch, north of Lewiston on the Trinity River, was placed in operation during the early part of January.

AUBURN FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

New Report on the Mother Lode Region by the State Mining Bureau.

As the only agency maintained by the State of California to aid and encourage the development of the vast but only partly utilized mineral resources of the commonwealth, it is the duty of the State Mining Bureau to give information on every phase of mining to the inquirer. Among other duties, the Bureau is directed by law to "make, facilitate and encourage special studies of the mineral resources and mineral industries of the state." Under this head comes the new report being prepared on the gold quartz mines of the Mother Lode region. This report (for which a great deal of information not hitherto published has been gathered already) is intended to bring up-to-date in one volume as much as can be learned of the geology, production, history and possibilities of the Mother Lode district.

The first step in this work was the preparation of a new list of mine owners, who must be consulted in a great many cases to get maps and other details regarding idle mines. Often the owners know little about their properties, having come into possession of them by inheritance or purchase when no work was going on. In such cases former superintendents and employes must be found, as these men are often the only source of accurate information. Their knowledge of the mines must be saved, as the loss of it is a very serious handicap if the property is ever reopened.

For a new claim map of the region the various available district maps of private engineers and the records of the U. S. Land Office will be combined and brought to a common scale.

The areal geology of much of the region has been shown in the U. S. G. S. folios on a small scale. It is believed that something can be contributed to the geologic record by examining the geology of a number of selected localities along the lode and recording it on a scale large

enough to show details of structure and formations that could not be shown on the above folios. This involves new field work along parts of the lode that have not received much attention in past reports.

Details are being collected regarding the occurrence, size and disposition of ore-shoots and the observed geologic conditions thought responsible for ore formation. The proper interpretation of this information, gained from visits to active mines and from maps and records of those now closed, is of value when applied to unexplored territory on the same lode. The history of the mines will be preserved in easily accessible form instead of being scattered and lost when mines are closed, maps and records are burnt and owners move away or die.

For the proper classification of wall rocks and ores thin sections of specimens will be studied.

Some study will be made of the mines northward from El Dorado County to determine their relation, if any, with the mines to the south, in the commonly accepted Mother Lode section.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

Monterey County.

Monterey Bay Salt Company, Vierra Bros., owners, Moss Landing, California. This property is located at sea level at Moss Landing. The Pajaro Valley Railroad (narrow gauge) connects it with Watsonville. It is also on a steamer landing, as indicated by the name.

Salt is extracted from sea water at this plant by solar evaporation. The salt works comprises four ponds. Two months are required for the water to evaporate to the density at which the salt crystallizes out and settles on the bottom of the ponds. The layer of crystals is from 4 inches to 6 inches in thickness.

After the salt has formed, the ponds are drained and the salt is then broken up with shovels and pumped, with saturated brine as a carrier, to a washing plant. Here it is washed, then crushed and screened, and put on the market without further refining.

The product is sold mostly to fish-curing plants at Monterey and to ice cream plants, dairies, and cattle men. Nine or more men are employed in season.

The salt from the waters of the Pacific at this point shows a high analysis, and is said to be more uniform than that from San Francisco Bay water on account of the river waters flowing into the latter. It contains very little magnesia. An analysis of a moisture-free sample shows:

	Per cent
Sodium Chloride (Na Cl)	99.75
Magnesium Chloride (Mg Cl_2)	0.00
Sodium Sulphate ($\text{Na}_2 \text{SO}_4$)	0.05
Calcium Sulphate (Ca SO_4)	0.14
Water insoluble matter	0.06
Organic matter	nil
Total	100.00

LOS ANGELES FIELD DIVISION.

M. A. NEWMAN, Mining Engineer.

Kern County.

Western Silica Company. The silica deposit of this company is located 18 miles east of Lancaster, or 13 miles southeast of Muroc. It consists of a wide vein of bull quartz, which is being mined by glory hole methods. About 20 per cent of wall rock is sorted out in the process of mining. The material shipped runs 98 per cent silica. About two cars a week at present are being shipped to Los Angeles. A portable Chicago Pneumatic Compressor is used in the mining operations.

P. Carney is president and superintendent of the company.

San Bernardino County.

The Rand District. The big Kelly Mine was discovered by Hamp Williams, April, 1919. Nearly four years have now elapsed, and the outstanding feature of this period is the development of one large and profitable mine in the holdings of the California Rand Silver, Inc.

Next to the holdings of the California Rand Silver, Inc., the Coyote, of the Randsburg Silver Mining Company, has given most promise of developing into a mine of real importance.

Following the Coyote, the Rand Silver King, Inc., locally known as the Bisbee Bray, has developed a number of veins of medium grade ore, but nothing of a shipping grade. The present development now taking place in the Silver King, Black Hawk, Grady, Crites, and Silver Basin shafts, will answer as to what the future of the silver zone of the Rand District will be. Due to the fact that a granite wash, which is several hundred feet thick, covers the entire region east of the so-called 'dyke,' near which the apex of the Kelly Mine was found, it means that a company must spend at least \$25,000 to get a 'look in' as to what may lie under it. However, this expenditure is entirely legitimate and justifiable when the possibility of finding such extremely rich ore as found in the Kelly Mine is taken into consideration.

Grady and Sill. After making a fortune out of the Grady lease on the Big Kelly Mine (California Rand Silver, Inc.), Grady and Sill decided to invest part of their profits on deep development work in the camp. At a point approximately 3000 feet southeast of the main shaft of the Kelly, the Grady shaft was sunk. It is now 1095 feet deep. It first passed through 665 feet of granite wash and then encountered the schist formation. At a depth of 815 feet, the first showings of ruby silver were seen. A station was cut at a depth of 975 feet and a crosscut run north 93 feet, where the vein was cut. This was then drifted on west for 150 feet and averaged 2 to 4 feet in ore-bearing material, giving small values in silver. At present a crosscut is being run from the 1085 foot station to cut the vein. Crosscut now is in 100 feet. Owners, Grady and Sill.

Johannesburg Mining and Milling Company. This company, controlling the Silver King and Silver Moon properties, is under lease to what is known as the *Moon King Leasing Company*. Its principal

stockholders are Tacoma people and its Silver King property is considered among the more valuable in the silver belt of the Rand District.

The Silver King Group of this company lies about 1800 feet easterly from the main shaft of the California Rand Silver, Inc. The group consists of the following claims: Silver King 1, 2, 3 and 4, and the Lucky Fraction. Approximately 86 acres.

The Silver King shaft has been sunk near the northwest corner of Silver King claim No. 2. After sinking through 555 feet of a consolidated granite wash or 'Arkose' formation, the shaft entered the so-called schist formation of the region and at a depth of 603 feet the first showings of ruby silver were encountered. From 603 feet to 682 feet, the shaft was in mineralized schist. Car samples of the material as hoisted between the above depths averaged from \$8 to \$34 a ton. Samples taken of the rich streaks gave values of \$100 and better per ton. At the depth of 682 feet the shaft passed through the vein or mineralized schist. It is proposed to crosscut east at a depth of 700 feet in the shaft to cut the vein and then drift both ways to explore the extent of this ore body. The finding of ore in this shaft is one of the most important developments in the district and much new development is anticipated to the east and northeast of the Silver King Group.

The Silver Moon Group lies about 400 feet west of the main shaft of the California Rand Silver, Inc. It consists of the Silver Moon Claim and the Belle Brown Fraction.

Considerable development work has been done on the property, as follows: The shaft has been sunk to a depth of 550 feet. On the 300-foot level a crosscut was run west 140 feet and also to the east 102 feet. A vein 5 to 6 feet wide was cut 35 feet east of the shaft, assaying \$2 to \$3 in gold and one ounce silver per ton. A drift was run on the vein 35 feet north and 25 feet south. Its course was N. 30° E. and dip 45 degrees southeasterly. On the 515-foot level a crosscut was run 347 feet east. At 269 feet a vein was cut and drifted on 35 feet north and south where cut.

President and general manager, Moon King Leasing Company, W. P. Buckley; secretary, Frank Oakley. Office, Tacoma, Washington.

Pittsburg Mount Shasta Mining and Milling Company. (Black Hawk). This company is sinking a new vertical shaft about 150 feet south of the south line of the Rand Silver King, Inc. The shaft is now down 578 feet. It was sunk through 140 feet of consolidated wash and then entered the silver bearing schist formation. Inasmuch as the Rand Silver King, Inc., has a number of veins, which will in all probability enter the claims of this company, the sinking of this shaft gives much promise of favorable developments. It is planned to crosscut the formation when the shaft attains a depth of 700 feet.

J. O. Greenan is superintendent of the property.

Rand Consolidated Silver Mining Company. This company has started sinking a 1000 foot shaft on the Big Four claim. It is located about 2000 feet northeast of the Silver King shaft, and is in direct line of the

zone of mineralization as extended from the most recent developments in the workings of the California Rand Silver, Inc.

The company is financed by strong Bakersfield interests and the work will be prosecuted with all possible speed.

A. J. Crites of Bakersfield is president of the company.

Silver Basin Mining Company. This company, whose claims lie about 3000 feet south of the new shaft of the Pittsburg Mount Shasta Mining and Milling Company (Black Hawk), controls the following claims: Golden Era, Hidden Treasure, Ransome, Mandan Fraction, O'Farrell Fraction and Y. W. Fraction. In all, 60 acres.

A vertical shaft $4\frac{1}{2}$ feet by $7\frac{1}{2}$ feet is now being sunk to a depth of 600 feet. If this development proves successful in opening up new silver veins in the schist formation it will mean much for the future of the camp, as this development will be nearly one mile south of the main shaft of the California Rand Silver, Inc., and will do much to prove out the silver area of this region.

K. S. Snowlton, president. Office, Redlick Building, Bakersfield, Cal.

San Bernardino County.

Alvord Mine. This well known old gold property, situated out from Yermo, is soon to be reopened, according to information received from the owner, Mr. McCormick of Yermo.

L. S. Emerson is developing a gold prospect in the Dry Lake Mining District, situated 60 miles east of Victorville. A drift is being run in on a vein two to four feet wide, which is said to assay \$32 gold, per ton. Drift now in about 50 feet.

The old *Fortuna Mine* in this same section is also to be reopened by Mr. Emerson.

Myrick. A prospect of much promise has been opened up by 'Shady' Myrick of Johannesburg. It is situated 45 miles east of Johannesburg.

The formation here consists of steeply-dipping quartzites, altered limestones and shales. Several rhyolite dykes have also been intruded between the bedding planes of the above. The general strike of the formation is north and south. Cutting across this formation in a northwesterly and southeasterly direction is a gold-bearing vein which at several points has been exposed by open cuts. Pannings taken of this vein show values of \$30 and better.

At the time the property was visited insufficient work had been done to accurately determine either the width or strike of the ore. The surface showings, however, well warrant the expenditure of money to more fully open up the ore.

It is reported the property is now under bond for \$150,000 and that an initial payment has been made.

'Shady' Myrick has prospected the desert for many years and has to his credit the discovery of a semi-precious stone which has been called Myrickite after him.

The property consists of the following claims: Black Gold Nos. 1, 2, 3, 4, and 5, Lime, Red Rock and Palmyra, approximately 140 acres in all.

F. M. Myrick, Johannesburg, owner.

Pacific Marble Quarries Company. This old Baxter quarry situated at Baxter, 197 miles east of Los Angeles on the Union Pacific Railroad, is being reopened for large scale operation by the above company. A railroad spur has been put in by the Union Pacific, and the management reports that a daily production of 250 to 300 tons will soon be maintained. This limestone is to be shipped to sugar plants and smelters. Lime is also to be made for building purposes.

About 20 men employed at present.

Company has offices at 341 Citizens National Bank Building, Los Angeles.

President, R. B. Knox; secretary and treasurer, J. M. Finlayson; general manager, W. A. Griffing; superintendent, M. J. Johnson.

Smith Mine. This gold property is one and one-half miles west of Baxter and one-half mile north of the Union Pacific Railroad. It consists of the three claims—Ben, Ben Extension, and Trojan. The veins occur in a diorite dyke near a rhyolite contact and the outcrop is very noticeable, due to oxidation.

Vein courses northeast and southwest and is nearly vertical. Development consists of a 50-foot shaft on the Ben claim.

Several thousand dollars of high grade ore was shipped out of this shaft.

At present a crosscut tunnel is being run to cut this vein at a greater depth at a point under the bottom of the shaft.

Ed Smith, owner. Address, Baxter, Cal.

OIL FIELD DEVELOPMENT OPERATIONS.

R. E. COLLOM, State Oil and Gas Supervisor.

From January 13, 1923, to and including February 10, 1923, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
FRESNO COUNTY:					
Paragon Oil Company.....	17	19	15	16	Coalinga
St. Paul Cons. Oil Company..	18	19	15	1	Coalinga
KERN COUNTY:					
Belridge Oil Company.....	34	30	24	4	Elk Hills
Pacific Oil Company.....	35	30	24	102	Elk Hills
Pan American Petroleum Co..	35	30	23	1	Elk Hills
Union Oil Company.....	26	30	24	Elk Hills 4	Elk Hills
Union Oil Company.....	26	30	24	Elk Hills 3	Elk Hills
Berry & Ewing.....	31	32	24	8	Midway
C. C. M. O. Company.....	8	32	23	78	Midway
North American Oil Cons....	30	31	24	1	Midway
Pacific Oil Company.....	25	31	23	35	Midway
Pacific Oil Company.....	7	32	24	41	Midway
Pacific Oil Company.....	5	32	24	36	Midway
El Dora Oil Company.....	6	12	23	1	Sunset
Lakeview No. 2 Oil Company..	4	11	23	Midfields 8	Sunset
Surprise Oil Company.....	36	32	23	9	Sunset
C. C. Magenheimer et al.....	20	25	27	1	-----
Standard Oil Company.....	28	11	20	Kern Co. 2	2
Standard Oil Company.....	28	11	20	Kern Co. 2	3
LOS ANGELES COUNTY:					
Anchor Oil Company.....	19	4	12	Henderson 1	Long Beach
Anchor Oil Company.....	19	4	12	Butler 2	Long Beach
Bush-Voorhis Oil Company....	19	4	12	8	Long Beach
Bush-Voorhis Oil Company....	19	4	12	10	Long Beach
California Signal Oil Company	30	4	12	1	Long Beach
Casa Blanca Oil Company....	19	4	12	Barteau 1	Long Beach
Commonwealth Trust.....	19	4	12	1	Long Beach
Cunningham Oil Company....	30	4	12	1	Long Beach
Dabney Oil Syndicate.....	36	4	12	23	Long Beach
Davis & MacMillan.....	30	4	12	5	Long Beach
de Lendrecie Oil Well.....	19	4	12	Garrett 2	Long Beach
Edens & Bernstein.....	19	4	12	1	Long Beach
Walter H. Fisher.....	30	4	12	4	Long Beach
Fred B. Foster & Co.....	19	4	12	42	Long Beach
Fred B. Foster & Co.....	19	4	12	41	Long Beach
General Petroleum Corp.....	20	4	12	Secoco 5	Long Beach
General Petroleum Corp.....	19	4	12	K. & H. 2-A	Long Beach
Golden Eagle Oil Company....	30	4	12	2	Long Beach
Golden Eagle Oil Company....	30	4	12	3	Long Beach
Golden West Syndicate.....	29	4	12	1	Long Beach
Henderson Petroleum Syn....	30	4	12	Kethroe 1	Long Beach
Huntington & North. Pet. Co.	30	4	12	4	Long Beach
Huntington & North. Pet. Co.	30	4	12	5	Long Beach
Huntington & North. Pet. Co.	30	4	12	6	Long Beach
Interstate Oil Corporation....	29	4	12	Goddard 2	Long Beach
A. T. Jergins Trust.....	19	4	12	5	Long Beach
Keek Syndicate No. 4.....	30	4	12	2	Long Beach
Keek Syndicate No. 5.....	29	4	12	2	Long Beach
E. G. Lewis.....	30	4	12	1	Long Beach
Marine Oil Corporation.....	29	4	12	5-A	Long Beach
L. H. Mitchel & Sons.....	30	4	12	1	Long Beach
Pan-Hellenic Oil Company....	19	4	12	1	Long Beach
Pan-Pacific Cons. Oil Co....	20	4	12	2	Long Beach
Petroleum Midway Co., Ltd..	30	4	12	Nelson 1	Long Beach
Prouhet & Troupe.....	19	4	12	Oliver 1	Long Beach
Queen City Drilling Company	24	4	13	1	Long Beach
Rex Oil Company.....	19	4	12	Jarrel 1	Long Beach
Rogers Oil Well.....	23	4	12	Rogers 2	Long Beach
Shell Company.....	20	4	12	Marecllus Com. 4	Long Beach
Shell Company.....	28	4	12	Connett 1	Long Beach
Signal Hill Oil Syn No. 1....	19	4	12	Malin 1	Long Beach
Signal Union Syndicate.....	30	4	12	1	Long Beach
Superior Oil Company.....	29	4	12	Swaffield 2	Long Beach
Tay Bar Syndicate.....	30	4	12	1	Long Beach
E. D. Taylor Oil Syn. No. 1..	19	4	12	1	Long Beach

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES CO.—Continued:					
Union Oil Company.....	30	4	12	L. B. Com. 9	Long Beach
United Oil Company.....	30	4	12	Hass 6	Long Beach
Windermere Oil Company.....	19	4	12		Santa Fe Springs
Amalgamated Oil Company.....	5	3	11	Butterworth 7	Santa Fe Springs
Amalgamated Oil Company.....	5	3	11	Butterworth 8	
Ambassador Petroleum Corp.....	5	3	11	Baker 1	Santa Fe Springs
Are-Bee Oil Syndicate No. 2.....	7	3	11		Santa Fe Springs
Coalinga Mohawk Oil Co.....	7	3	11	Parkford 1	Santa Fe Springs
General Petroleum Corp.....	5	3	11	Santa Fe (8-A)	Santa Fe Springs
Gilbert Petroleum Interests.....	7	3	11	1	Santa Fe Springs
Industrial Oil Syn. No. 4.....	7	3	11	4-2	Santa Fe Springs
Industrial Oil Syn. No. 5.....	7	3	11	1	Santa Fe Springs
C. C. Julian.....	6	3	11	3	Santa Fe Springs
Lawrence Santa Fe Oil Co.....	7	3	11	Owen 1	Santa Fe Springs
Lincoln Oil Syn. No. 1.....	18	3	11	1	Santa Fe Springs
Russel Petroleum Company.....	1	3	12	2	Santa Fe Springs
Santa Fe Dome Oil Co.....	8	3	11	Meyer 1	Santa Fe Springs
Santa Fe Sprgs. Oil Syn. No. 1	6	3	11	3	Santa Fe Springs
H. S. Sewell & Co.....	7	3	11	1	Santa Fe Springs
Shamrock Oil Syndicate.....	8	3	11	1	Santa Fe Springs
Shell Company.....	6	3	11	Slusher 2	Santa Fe Springs
Shell Company.....	31	2	11	Thompson 2	Santa Fe Springs
Standard Oil Company.....	6	3	11	Johnson 5	Santa Fe Springs
Standard Oil Company.....	6	3	11	Walker Com. 9	Santa Fe Springs
Standard Oil Company.....	5	3	11	S. Whittier Com. 11	Santa Fe Springs
Triangle Oil Company.....	7	3	11	1	Santa Fe Springs
Joe B. Turman Oil Syn. No. 2.....	12	3	12	2-B	Santa Fe Springs
Union Oil Company.....	31	2	11	Howard 5	Santa Fe Springs
Union Oil Company.....	5	3	11	Meyer 7	Santa Fe Springs
Union Oil Company.....	6	3	11	Alexander 7	Santa Fe Springs
Union Oil Company.....	5	3	11	Farwell 4	Santa Fe Springs
C. C. M. O. Company.....	15	4	14	Torrance 5	Torrance
George F. Getty.....	8	4	14	Frederiksen 1	Torrance
Standard Oil Company.....	8	4	14	Kirk Com. 3	Torrance
Standard Oil Company.....	10	4	14	Torrance Com. 3	Torrance
Consolidated Mutual Oil Co.....	31	3	13	1	-----
ORANGE COUNTY:					
Catalina View Oil Company.....	35	5	11	2	Huntington Beach
Globe Petroleum Corp.....	34	5	11	4	Huntington Beach
Huntington Signal Oil Co.....	2	6	11	2	Huntington Beach
Miley-Keck Oil Company.....	2	6	11	33	Huntington Beach
Miley-Keck Oil Company.....	2	6	11	34	Huntington Beach
Miley-Keck Oil Company.....	2	6	11	35	Huntington Beach
Miley-Keck Oil Company.....	2	6	11	36	Huntington Beach
Miley-Keck Oil Company.....	2	6	11	42	Huntington Beach
Petroleum Midway Co., Ltd.....	2	6	11	Krahling 1	Huntington Beach
Republic Petroleum Company.....	2	6	11	Community 5	Huntington Beach
Republic Petroleum Company.....	2	6	11	Community 6	Huntington Beach
Shell Company (U. D.).....	2	6	11	Davenport 6	Huntington Beach
Standard Oil Company.....	2	6	11	Williams 1	Huntington Beach
Union Oil Company.....	34	5	11	Copeland 13	Huntington Beach
SAN BERNARDINO COUNTY:					
Mizpah Oil Company.....	16	11	9	1	-----
SANTA CRUZ COUNTY:					
Danish Oil & Development Co.	Rancho Refugio	11	2	2	-----
STANISLAUS COUNTY:					
E. D. Irons.....	30	6	8	1	-----
TULARE COUNTY:					
W. R. Mitchell.....	22	24	24	1	-----
VENTURA COUNTY:					
Schell & Jennings.....	32	4	18	5	Piru
W. H. de Grummond.....	21	4	21	Ahnlauf 1	Santa Paula
Oak Ridge Oil Company.....	13	3	21	Harvey 11	South Mountain
Oak Ridge Oil Company.....	13	3	21	South Mountain 12	South Mountain
Oak Ridge Oil Company.....	18	3	20	Willard 14	South Mountain
General Petroleum Corp.....	28	3	23	Notten 4	Ventura
Golden West Association.....	4	2	23	2	Ventura
Shell Company.....	28	3	23	Taylor 6	Ventura

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff containing much information that will add to the permanent value of the Monthly Chapter are included in each number of 'Mining in California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

MINING LOCATION ON STOCK-RAISING LANDS.

(Numerous inquiries have been received by the State Mining Bureau regarding the rights of a mining claim locator on land taken up under the Act of Congress, entitled "An act to provide for stock-raising homesteads, and for other purposes," commonly called the 640-acre homestead act; where such holdings conflict with mining claims or include mineral-bearing land.

At the request of the State Mineralogist, the following statement setting forth the rights of a mining locator on such lands was prepared by the United States Bureau of Mines, and may be taken as official.)

RIGHTS OF LOCATOR.

"The rights of a locator of a mining claim on grazing or stock-raising lands, is governed by section 9 of the Act of Congress, approved December 29, 1916, entitled 'An act to provide for stock-raising homesteads, and for other purposes.' (39 U. S. Stats., 862.)

"The entries and patents issued under the act must contain a reservation to the United States of all coal and other minerals in any such lands, 'together with the right to prospect for, mine, and remove the same.' Any coal or other mineral deposits in any such lands are subject to disposal by the United States, according to the coal and mineral land laws in force at the time of any such disposal. All qualified persons are expressly given the right at all times to go upon any such lands entered or patented, for the purpose of prospecting for coal or other mineral therein. Any such prospector, however, is not to injure, damage or destroy any permanent improvements of any such entryman or patentee, and he is required to compensate the entryman or patentee for any damage on such lands.

"A prospector who has thus discovered coal or minerals in or upon any lands that have been entered or patented as grazing or stock-raising lands under the provisions of the act, may, upon acquiring from the United States, the coal or other mineral deposits in such lands, and the right to mine and remove the same, then re-enter and occupy so much of the surface of such land as may be reasonably incident to the mining

and removal of the coal or other minerals, but upon the following conditions:

"1. Before re-entering for mining and removing the minerals, he must secure the written consent or waiver of the homestead entryman or patentee, and

"2. He must pay damages to crops or tangible improvements if and when an agreement is reached as to the amount of such damages.

"In lieu of either of the provisions numbered 1 or 2, he may execute a bond or undertaking to the United States for the use and benefit of the entryman, patentee or owner of the land, to secure the payment of all damages to crops or tangible improvements of the entryman or owner, as such damages may be determined and fixed in an action brought upon the bond or undertaking in any proper court. The bond or undertaking must be in form and in accordance with rules and regulations prescribed by the Secretary of the Interior and is to be approved by and filed with the register and receiver of the land office in the district wherein the land is situated.

"Any patents issued for coal or other mineral deposits under the provisions of the act, must contain notations declaring them to be subject to the provisions of the act with reference to the disposition, occupancy and use of the land as permitted to an entryman or patentee.

"Under the first section of the act no land can be entered as a stock-raising homestead until the lands shall have been designated by the Secretary of the Interior 'as stock-raising lands.' After the lands have been so designated by the secretary, then qualified persons may enter and hold the same for the purposes contemplated by the act and may hold and possess the same for such purposes as against all persons except mining prospectors and those who have acquired the right to mine and remove minerals discovered, as provided in section 9.

"An entryman, patentee or owner of any such lands may, without doubt, make a valid mining location upon the lands, the same as any other person, but in making his mining location, he must comply with the law in manner and form as if he were a stranger.

"The entryman, patentee or owner of lands acquired under this act for grazing or stock-raising purposes, has no preference right whatever to locate a mining claim upon the land. In this respect he is on an equality with all other persons and can take no advantage whatever of the fact that he is the owner or in the possession of the land.

"The rights of all persons making mining locations upon any such land used for grazing or stock-raising purposes, must be measured and determined by the rules of priority that govern in relation to the location of mining claims upon public lands generally.

"Such grazing or stock-raising lands, held under the act, are, for the purposes of making mining locations, in effect, public lands.

"The fact that the notice of a mining location was posted in the night time could not affect its validity, if the locator otherwise complied with the law.

"The owner or occupant of any such grazing or stock-raising lands who defaces or destroys a notice posted upon such lands of a mining location, is subject to the same penalty and punishment as a person who destroys any notice of a mining location."

LIMESTONE DEPOSITS OF McCLOUD RIVER, SHASTA COUNTY, AND THEIR POSSIBLE VALUE FOR CEMENT MATERIAL.

By W. B. TUCKER, Mining Engineer.

Description of the McCloud Limestone.

In the Redding Folio of the United States Geological Survey this belt of limestone is described as follows: The limestone can be traced more or less continuously for twenty-five miles from the north end of the Sacramento Valley, near Lilienthal, northward to Nawtawakit Mountain, where it passes beyond the quadrangle boundary. Near Lilienthal it begins with a series of small limestone lenses, apparently included in Dekkas andesite and worn down to the level of the valley plain. Although much metamorphosed and in some places wholly crystalline, they contain distinct traces of fossils definitely fixing their



View of McCloud Limestone Exposure, Section 13, Township 34 North, Range 4 West, Shasta County.

age. Farther north they rise above the plain and form hills increasing in prominence to Gray Rocks. For ten miles beyond Pit River the escarpment of the McCloud limestone forms one of the principal topographic features, but it is very much cut up by quartz-augite-diorite into irregular patches of limestone separated from one another by distances varying from a few feet to over two miles. How much of this irregularity may be due to the original lenticular character of the limestone is not known, but there can be no doubt that it is mostly due to the dissecting igneous rock. The largest mass is that opposite the United States Fishery, in Sec. 13, T. 34 N., R. 4 W. Two other large masses occur in the Hirz Mountain region, but farther north, in the western portion of Nawtawakit Mountain, there is a considerable decrease in size.

The largest and most accessible exposures of the McCloud limestone are at Gray Rocks, near Bayha, the old Bass's ranch locality and farther north on the McCloud River opposite the United States Fishery. The two localities are separated by quartz-augite-diorite, which cuts the limestone.

Topography.

The McCloud limestone generally resists weathering more effectively than the associated quartz-augite-diorite, so that it usually gives rise to bold outcrops and, where large, becomes one of the principal factors in the topography, forming prominent ridges and peaks.

Thickness.

In thickness the McCloud limestone varies from 200 feet or less near the south end, where it appears in small lenses, to approximately 2000 feet in the prominent rugged mountain formed by it a short distance northeast of the United States Fishery.

Relation to Adjacent Formations.

Throughout the greater part of its extent in the Redding quadrangle the McCloud limestone is bounded both east and west by quartz-augite-diorite, but for over two miles south of the Black Diamond mine it lies conformably between the Baird and the Nosoni formation.

Lithologic Character.

The limestone is dark gray and massive below, and lighter colored and somewhat thinner-bedded above, with many nodules and sheets of gray chert, often containing silicified fossils.

Analysis of a sample of limestone from the deposit opposite the United States Fishery, submitted by Mr. E. W. D. Johnson, made by Smith, Emery and Company of San Francisco, is as follows:

	Per cent
Silica (SiO_2)	1.10
Alumina (Al_2O_3)24
Iron oxide (Fe_2O_3)20
Lime (CaO)	52.16
Magnesia (MgO)	2.38
Loss in ignition	43.96
Total	100.04
Purity as carbonate of lime (CaCO_3)	93.2

Possibilities of the Use of the

McCloud Limestone for Cement Material.

The largest and most accessible exposures of the McCloud limestone are in Sections 12, 13, 14, 23, and 24, T. 34 N., R. 4 W., M. D. B. and M. In these sections there is an inexhaustible supply of limestone which, due to its low magnesia content, is satisfactory for the manufacture of cement. The prominent rugged mountain, northeast of the United States Fishery, has an elevation of 3114 feet above sea level. The limestone here allows an elevation above the base exposed on the mountain

of over 1600 feet. Where exposed by erosion of a canyon to a depth of 1600 feet on the south end of Sec. 13, the deposit shows a thickness of fully 2000 feet.

Transportation.

These deposits are $2\frac{1}{2}$ miles north of the Sacramento and Eastern Railroad, which crosses the McCloud River at its mouth and continues up the Pit River to the Bully Hill smelter of the Shasta Zinc and Copper Company, at Winthrop, a distance of 17 miles. This railroad connects with the main line of the Southern Pacific four miles below the mouth of the McCloud River. The distance from San Francisco on the main line of the Southern Pacific is 253 miles, to Pit Station, the terminus of the Sacramento and Eastern Railway.

Power.

Hydro-electric power is available from the lines of the Northern California Power Company. The nearest substation is located at Heroult, about three miles south of the property. The published rate for extensive industrial use is about three-fourths of a cent per kilowatt hour.

Shale.

One mile and a half distant from the United States Fishery are large deposits of shale, located on the opposite side of the McCloud River, in section 16, T. 34 N., R. 4 W., about 400 feet above the elevation of the river.

This deposit has been estimated by M. E. Dittmar, to contain approximately 200,000,000 tons of shale, as a cross-section of the erosion shows a thickness of over 300 feet, and average width of half a mile. The state highway crosses the northernly end of the shale deposits.

Analysis of sample from this shale deposit submitted to Smith, Emery and Company of San Francisco, is as follows:

	Per cent
Silica (SiO_2)	57.51
Alumina (Al_2O_3)	19.85
Titanium oxide (Fe_2O_3)81
Iron oxide (Fe_2O_3)	8.28
Manganese oxide (Mn_2O_3)	1.34
Lime (CaO)	2.98
Magnesia (MgO)	2.61
Loss in ignition	4.46
Alkalies (by diff.)	3.16
Total	100.00

Conclusions.

These deposits of limestone and shale will furnish an inexhaustible supply of raw material for the manufacture of cement and are situated only a short distance from railroad transportation.

THE PROBLEM OF EXPLOITING THE SMALL MINE AND PROSPECT.

By C. A. LOGAN, Mining Engineer.

A general survey of the district extending from Plumas County on the north through Mariposa County on the south and including the principal mining counties of east-central California, shows that about two-score gold-quartz mines have had individual production records of from a million to several millions of dollars each. Considering the relatively limited scale of operations and the shallow depths reached in most cases, their histories indicate great possibilities for many of those small mines and prospects that now lie idle in the district. Why are so many of these idle? What has been the tendency in recent years of those operators who have been able to command adequate money for mining? Everyone is familiar with the effect of high prices of labor and materials, the resulting high costs of mining, and the business conditions that have attracted money to other fields. At the same time, prosperous companies have been spending a good deal of money in their own way in mine development in California. But while demanding from mining a high prospective yield, they have tried to sidestep as many as possible of the inherent risks of the business. In line with this policy they have set up hard and fast conditions that can not be met by the average small owner and prospector. The following expression by the superintendent of one of these large companies is typical of the attitude taken by many of them:

"Since the owner of the claims mentioned has no records of the past production it would be impossible to interest the company, as they would want to see an assay plan, or mint returns of the gold produced."

The property referred to is a prospect located on one of the strongest vein systems in the state, lying between former good producers, and typical of a great number in the California gold belt. They are really grass-root prospects. Many of them have produced some rich ore at and near the surface, else no attention would ever have been given them. This ore may have been the rich pocket rock characteristic of the surface zones of most of the mines later proven in depth, or it may have been from the stumps of ore shoots mostly removed by erosion. But there has been no accurate and detailed written record kept of the results as work was being done. The prospector is not as a rule a man of literary bent; he writes reluctantly and with difficulty. He relies on human contact. If mining companies will not establish contact with him by sending sympathetic, even if sophisticated, scouts out into the field to meet him and if necessary call his bluff by examining and sampling his claims, the record of his work will be lost with him. With the recent successful development of many California mines at depths of 4000 feet and more, and the light that has been thrown on geology by this deep work, the fissure veins have been proven to be a deep-seated type. There is ample precedent in the success of many companies to justify unproductive sinking for 500 to 1000 feet between ore shoots and by the same token it appears reasonable to prospect undeveloped properties where observable conditions are right. It is not reasonable to think that all ore shoots must outcrop, and as a matter of fact such mines as the Argonaut, South Eureka, Tightner

and others were covered by lava and gravel caps. They would not have been opened had it not been for the information gained in adjacent mines by men of initiative, or as in the case of the Tightner, where the old miners' tales came to the ear of a man who could listen sympathetically and act on what he heard.

The larger companies have lately been doing little real field work or prospecting for new mines in California. A few prospects that have been brought to their attention have been superficially examined, but little money has been spent by them in untried properties. They have devoted their attention chiefly to old mines with notable past production records, as will be borne out by a short summary of the principal activities they have engaged in, at least as concerns operations carried on avowedly for company account. None of the old established companies are known to have brought in a single new notable producing quartz mine in this state, nor to have done any important work in any new or hitherto unimportant district in northern California, for a number of years. Following is a list of the principal properties that have received attention from them:

Plumas County. Philadelphia Exploration Company equipped and unwatered the old Crescent and Green Mountain Mines at Crescent Mills. After extended and expensive exploratory work below the old levels, they quit without milling any ore. No well financed company has done any work lately in the county in gold mining.

Sierra County. Work by the better financed companies has been centered around the mines of the Alleghany district. The Tightner has been put into production again. The records of the Plumbago, Tightner, and 16 to 1 have attracted notice and North Star Mines Company, Tonopah Mining Company and Alleghany Mining Company are engaged in reopening old mines with good past records.

Nevada County. No large company has undertaken the exploration of new property. The Harry Payne Whitney interests have been spending large sums in rehabilitating the Idaho-Maryland group.

Placer and El Dorado Counties. No well financed company has attempted any work of late in these counties, except for one small venture by Metals Exploration Company in eastern Placer. Work started on old properties at Nashville just before the war, was stopped when war was declared, as the capital for this work was coming from England.

Amador County. At present the scene of the principal development of the Mother Lode. The Old Eureka, Plymouth Consolidated and Freemont Mines, all well known past producers, have been reopened.

From the Moore Mine to Carson Hill there has been no recent important development except by a few inadequately financed companies. At Carson Hill and Melones the reopening and further successful exploitation of the Morgan Mine and Melones Mine by Carson Hill Gold Mines, Inc., has kept Calaveras County among the important bullion producers. North Star Mines Company prospected two old properties at West Point in 1921-22 without any production.

Tuolumne County. In contrast to the usual policy of the prosperous companies, Nevada Wonder Mining Company and Tonopah Mining Company have been doing some real prospecting in claims on Jackass Hill and in the Crystalline and Alabama Mines in this county.

If the larger and well financed companies will not hunt for new mines, who will? The field under consideration offers very attractive inducements to stock companies that are honestly conceived and managed and properly financed. A glance at the recent operations of the small, new promotions lately active in the state will indicate that they have not been as successful in contributing to the welfare of the industry as might be desired. Many of them have been based on old mines, and possibly for the same reasons that have actuated the larger companies in devoting so much of their money to this class of property. Astute promoters and engineers admit that it is easier to get money for rehabilitating and further exploring an old mine with a bullion record than it is to interest capital in a new venture. The following are some of the mines recently the subjects of promotion by companies that have put their stock out for sale in small parcels to many buyers, and the present state of these ventures:

Allison Ranch Mine. An expensive mill built before the mine had been adequately explored. Operation suspended after unsuccessful prospecting.

Rising Sun Mine. An expensive mill built before the mine had been unwatered or explored. Operation suspended after a little prospecting, as the funds had been exhausted to pay for surface improvements. No sinking was accomplished.

Patterson Mine. A very complete and quite expensive mill and surface plant were erected prematurely, and before the vein exposed had been properly sampled. Operation was suspended after crushing a few tons of ore which was found to be of unexpectedly low grade, and after an acute shortage of funds developed that had been hastened by heavy expenses on top.

These ventures were all based on old mines with good past records. In each case, too much credence was placed in the belief that good ore was waiting in the bottom to be milled, and the promoters were in such a hurry to begin production that mills were erected before the stories were fully investigated. In many such cases the stockholders themselves are to blame for demanding too early a return on their money, and in many others the trouble is due to insufficient financing, and the idea that the mine must be put into production at the earliest possible time, to pay its way, regardless of whether or not it has been developed to the point where it can sustain the needed output. The mournful monuments of wood and iron standing over so many idle mines, of which the above are merely cited as up-to-date samples, represent many a time enough money to have found good ore, if spent underground. It is poor business in every way to put up a mill before it is needed. While a mine is still unproven, its stock is naturally cheap and hard to sell. Therefore every available dollar should go toward proving ore. If ore is found, the stock at once increases in value and becomes easier to sell. It is never hard to finance mill

building if people can be shown enough ore to justify it, and the mill is not needed in any event until ore is proven, and represents so much capital tied up and unproductive until it can be put in operation. It is safe to say that lack of capital, lack of honesty and poor business judgment are responsible for at least half of the failures of such mining projects to come to a productive stage; few of them ever get sufficient development to show what they can do. The Allison Ranch Mine has been one of the few exceptions, and can be said to have been quite well explored by the last operators. The numerous promotions that have come and gone without contributing to the welfare of anyone except the stock salesman, is in sharp contrast to the few successful operations that have resulted when good business judgment, mining experience and good faith with the buying public have been combined, in charge of the promotion. But most of these have been based on old mines, and it is hard to recall in recent years any important examples of good mines developed from new prospects to important producers in this section of the state, as far as gold quartz mines are concerned. The Morgan Mine on Carson Hill had a record of about \$3,000,000 previously to its credit, but had lain idle 20 years when taken over by Wm. J. Loring. No consideration of the mines promotion problem would be complete without citing this successful example of what can be done with California mines if adequately financed and honestly and intelligently developed. There may not be another Morgan Mine in California; it is true that in the early days it produced the largest single piece of pocket gold ever found, worth about \$300,000. But there are many mines waiting for development that are well worthy of attention. If the stock buying public could be brought to the point of informing itself a little more fully of the merits of a mine promotion before parting with its money, there would be more dividends and more mine development. If the multitude of mine promotions based on California mines but incorporated in other states, were domestic corporations controlled by a fairly administered law, it would be a help to mining and to the stockholders, but the state law cannot reach beyond the border to prevent misrepresentation of some mines and consequent injury to the whole industry.

Another form of mine exploitation growing out of the desire of the promoter to escape the blue sky law, is the unit plan, which has been tried in a small way during the past year or two. The following are the main points in one of these projects submitted to the public last summer:

Mr. X secured an option to purchase certain claims, and concluded that \$25,000 was needed to finance their operation. He thereupon divided the option into 100 interests, or "units," to be sold at \$250 each.

On payment of \$250 each subscriber was held to be entitled to 1/100 interest (or more, at the same rate) in the option, and in case the option were closed, to a like interest in the property and any production from it.

The price of \$7,500 for the property to be paid as follows: \$1,000 cash on the subscription and sale of 20 units; \$1,500 cash on the subscription and sale of 30 units more; the balance to be paid with 30 units at par, at which time a deed would be given for the property.

No meeting of unit holders, and no provision in any way for their protection, or for safeguarding the funds or directing the spending of same, was provided for until the above 50 units had been sold. The main objection to this plan is that it places too great a responsibility and moral strain upon one man, and there is too much danger of the plan falling through before the unit holders even organize.

On the owner's side, we find in later years that there is an increasing number of absent owners, living in town or perhaps hundreds or thousands of miles away. When a man ceases to be a miner or prospector and leaves his claims because of choice or necessity, the prospective buyer has much less chance to become interested in them. This condition is partly due to the collapse of former mining booms, during which mines and prospects were eagerly bought by non-residents, and partly to the growth of urban life, the removal of successful former mine operators to the cities where they have invested the fortunes gained in mining, in other business, and their children have grown up strangers to the mines.

Summarizing, then, we see that on the one hand we have a number of well financed companies that are interested in finding new mines. They realize, that the properties on which their prosperity is based are wasting, and will last only a few years longer in many instances. They have good organizations and wish to continue mining. But they will not as a rule do much prospecting. They want something already brought to the point where there is evidence of a good sized mine in the making. This means at least a few hundred feet of development, with an exposure of ore sufficient to give hope of a good sized ore shoot, and with an assay record properly kept, and that will stand up under re-sampling.

On the other hand are the numerous non-resident owners of mines who are not miners, or for some reason are unable to put their properties in operation.

The situation would seem to call therefore for a class of middlemen to take hold of good prospects and bring them to the point where they are proven valuable or worthless. Properly handled stock companies, organized to develop mines, and with proper technical guidance, can render real service in this direction. The more good prospects that such a company can investigate, the better will be the chance of profit. If one out of four of these prospects makes a mine, the profits from the one property ought easily to care for all expense on the others and give a good net yield besides.

SECRETARY'S OFFICE.

W. W. THAYER, Secretary.

The California State Mining Bureau was created April 16, 1880, by legislative act. In March, 1893, the original act was repealed and an amended act approved and passed by the legislative body. Again on June 16, 1913, a new Mining Bureau Act was approved which became effective August 10, 1913, repealing all former acts, and forming the basic law under which the Bureau now functions.

It is doubtless true that both the mining and lay public have not in the past always recognized the part played by the Bureau in the development of the state's mineral resources. Innumerable inquiries regarding them, originating within and without its borders and in foreign countries, have been answered with ultimate results reflected by a consistent growth in the value of the state's mineral output since the records of production were first compiled by the Bureau in 1887.

It is believed that a better understanding of the economic position occupied by the Bureau will be imparted to the public, whose funds support it, by embodying in the Monthly Chapter a review of the executive activities.

The responsibility for the coordination of effort of each department, to the end that the utmost efficiency may be maintained with the limited and variable appropriations accorded the Bureau by successive legislatures, rests upon the office of Secretary.

Activities referable to that office, such as reports of new maps and publications issued, amount of mail handled, changes and enlargements in offices, changes in personnel of the staff, property and equipment, financial statements, etc., are therefore included herein.

New Publications.

During the month the following Bureau publications have been made available for distribution:

Summary of Operations, California Oil Fields, November, 1922, Vol. 8, No. 5.

Mining in California, November, 1922, (Monthly), Vol. 18, No. 11.

Distribution of Publications.

The Bureau's publications are constantly in demand, requests for copies coming from all over the United States and foreign countries.

Publications were distributed during the month as follows:

Publications	Number Distributed
Report XIV State Mineralogist.....	3
Report XV State Mineralogist.....	3
Report XVII State Mineralogist.....	6
Mines and Mineral Resources of Colusa, etc.	2
Mines and Mineral Resources of Del Norte, etc.	2
Mines and Mineral Resources of Fresno, etc.	2
Mines and Mineral Resources of Imperial, etc.	6
Mines and Mineral Resources of Alpine, etc.	5
Mines and Mineral Resources of Butte, etc.	3
Mines and Mineral Resources of El Dorado, etc.	5

Mines and Mineral Resources of Los Angeles, etc.	5
Mines and Mineral Resources of Monterey, etc.	3
Mines and Mineral Resources of San Bernardino, etc.	1
Mines and Mineral Resources of Nevada County	8
Mines and Mineral Resources of Plumas County	3
Mines and Mineral Resources of Sierra County	4
Bulletin No. 6, California Gold Mill Practices	1
Bulletin No. 37, Gems, Jewelers Materials, Ornamental Stones of California ..	6
Bulletin No. 50, Copper Resources of California (revised)	1
Bulletin No. 72, Geologic Formations of California	5
Bulletin No. 75, United States and California Mining Laws	9
Bulletin No. 76, Manganese and Chromium in California	1
Bulletin No. 78, Quicksilver Resources of California	5
Bulletin No. 85, Platinum Resources of California	61
Bulletin No. 89, Petroleum Resources of California with special reference to unproved areas	58
Bulletin No. 90, California Mineral Production for 1920, with County Maps ..	23
Mining in California (Monthly) Vol. 18 No. 10, October, 1922	75
Summary of Operations, California Oil Fields (Monthly) Vol. 8, No. 4, October, 1922	2875
County Maps and Registers of Mines	5
Copper Deposit Map	4
Inyo County Geological Map	1
Minaret Map	1
Tuolumne County Mineral Map	1
Geological Map of California, mounted	14
Lake County Map	1
Oil Field Maps	425
Map accompanying Bulletin 89	62

Mails and Files.

The Bureau maintains in addition to its correspondence file a mine report file, which includes reports on some 7500 mines and mineral properties in California. Also, there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the month 938 letters were received and answered. They are practically all requests for information and the inquiries cover all phases of prospecting, mining and developing mineral deposits, reduction of crude minerals and marketing of refined products.

Drafting Room.

The Bureau maintains an up-to-date drafting department, where topographic and geological maps, tracings, oil well logs, and oil field maps are prepared.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Statistician and Curator.

STATISTICS.

California produces commercially at least fifty different mineral substances, with a total annual value averaging in recent years in excess of \$250,000,000. There are several thousand operating properties, including mines, quarries, oil and gas wells, mineral springs, gravel pits, mills, and smelters. The task of compiling accurate and dependable statistics covering their activities is a difficult one, requiring care and a technical knowledge of properties and processes.

Since the inauguration of the Monthly Chapter, it is possible to publish the production figures for any mineral within a maximum period of thirty days from the date on which returns are complete. It is hoped that the early appearance of the figures for some of the minerals will induce other operators to cooperate, to the end that the complete statistical bulletin may be incorporated in one of the early mid-year issues of the Chapter. Blank forms were sent out in January, and the 1922 data are now coming to hand, so that we hope to be in a position to give some of the figures in the March issue.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections located in North America, and contains not only one or more samples of most of the known minerals found in California, but many specimens from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection. The Bureau supplies a set of forty typical minerals and ores, appropriately labeled, for study purposes to any public school in the state upon request. During the past 30 days, a total of 475 visitors signed their names to the Museum register, and in addition there are many others daily who fail to take note of our request for their signatures.

LABORATORY.

FRANK SANBORN, Petrologist.

A sample of allanite, a complex silicate containing some of the rare earth metals, was one of the 216 samples received during the thirty-day period covered by this report. This is the second sample of allanite from a California locality received at this laboratory during the past year.

A list of the samples having a possible commercial value, judged from the sample submitted only, is appended:

- 15-15 Phosphate of lime; also turquoise.
- 15-16 Psilomelane (manganese ore).
- 15-17 Gypsum.

- 15-18 Red Rock; suitable for stucco "dash."
- 15-19 Limestone; also volcanic ash.
- 15-20 Aresnopyrite.
- 15-21 Barite.
- 15-22 Silver-cobalt ore, nickel and copper present.
- 15-23 Garnet.
- 15-24 Altered material; contains silica, lime, phosphate, and fluoride.
- 15-25 Gold-copper ore.
- 15-26 Clay.
- 15-27 Silver ore; contains some gold.
- 15-28 Silver ore; also marble.
- 15-29 Gypsum.
- 15-30 Silver ore; very high grade.
- 15-31 Malachite (copper carbonate).

LIBRARY.

E. COONEY, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received during the month, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geol. Survey:

Bulletin 725—Contributions to Economic Geology, 1921. Part I, Metals and Nonmetals Except Fuels. By F. L. Ransome and E. F. Burchard, Geologists in Charge.

Bulletin 726—Contributions to Economic Geology, 1921. Part II, Mineral Fuels. By David White and M. R. Campbell, Geologists in Charge.

Bulletin 727—Potash in the Greensands of New Jersey. By George Rogers Mansfield.

Bulletin 739-B—Mineral Deposits of the Wrangell District, Southeastern Alaska. By A. F. Buddington.

Bulletin 739-C—Recent Investigations of Petroleum in Alaska (Cold Bay, Iniskin Bay, Anchorage, Nenana Coal Field). Papers by S. R. Capps, F. H. Moffit, A. H. Brooks and G. C. Martin.

Gold and Silver in 1921. By J. P. Dunlop.

Stone in 1921. By G. F. Loughlin and A. T. Coons.

Natural-Gas, Gasoline in 1921. By E. G. Sievers.

Prof. Paper 122—Copper Deposits of the Tryone District, New Mexico. By Sidney Paige.

Water Supply Paper 479—Surface Water Supply of the United States, 1918.

Part IX, Colorado River Basin. By Nathan C. Grover and Others.

U. S. Bureau of Mines: Reports of Investigations—

Serial No. 2419—Regulations Safeguarding Coal-Cutting Machines. By L. C. Hisley (Electrical Engineer, U.S.B.M.).

- Serial No. 2420—Experiments on Back Pressure on Oil Wells. By T. E. Swigart (Supt., Petroleum Experiment Station, U.S.B.M., Bartlesville, Okla.).
- Serial No. 2421—Natural Gas as a Factor in Oil Migration and Accumulation in the Vicinity of Faults. By R. Van A. Mills (Pet. Technologist, U.S.B.M.).
- Serial No. 2422—The Explosibility of Methane-Air and Gasoline-Air Mixtures as Related to the Design of Explosion-Proof Electric Motors. By E. J. Gleim (Associate Electrical Engineer, U.S.B.M.).
- Serial No. 2423—Explosives Used in October, 1922. By W. W. Adams (Statistician, U.S.B.M.).
- Serial No. 2424—Use of the Churn Drill at Lime-Plant Quarries. By Oliver Bowles (Mineral Technologist, U.S.B.M.).
- Serial No. 2425—A Section Through the New Albany Shale. By John R. Reeves.
- Serial No. 2426—Fire and Ventilation Doors in Metal Mines. By D. Harrington (Supervising Mining Engineer, B.M.).
- Serial No. 2427—Rock Strata Gases in Mines of a Nevada Mining District. By E. D. Gardner (Mining Engineer, U.S.B.M.).
- Serial No. 2428—Coal Mine Fatalities in November, 1922. By W. W. Adams (Statistician U.S.B.M.).
- Bulletin 201—Prospecting and Testing for Oil and Gas. By R. E. Collom.
- Bulletin 202—Electric Brass-Furnace Practice. By H. W. Gillett and E. L. Mack.
- Bulletin 218—The Technology of Slate. By Oliver Bowles.
- Tech. Paper 279—Economic Combustion of Waste Fuels. By David Moffat Myers.
- Tech. Paper 287—Preparation of Light Aluminum-Copper Casting Alloys. By R. J. Anderson.
- Tech. Paper 325—Natural Gas Manual for the Home. By R. A. Cattell.
- Circular 80, Bureau of Standards—Protective Metallic Coating for the Rust-proofing of Iron and Steel.
- Circular No. 135, Bureau of Standards—Caustic Magnesia Cement.
- Second Annual Report of the Federal Power Commission, 1922.
- Annual Report of the Chief of Engineers U. S. Army, Parts I and II. 1922.
- U. S. Department of Commerce Reports, January, 1922.
- Monthly Summary of Foreign Commerce of the United States, Part I, November, 1922.
- Report of the Department of Mines for the Fiscal Year Ending March 31, 1922, Ottawa, Canada.
- Canada Department of Mines, Geological Survey, Memoir 129, Geology of the Moncton Map-Area. By W. J. Wright.
- Memoir 132—Geology and Ore Deposits of Salmon River District, British Columbia. By S. J. Schofield and G. Hanson.
- Thirty-first Annual Report of the Ontario Department of Mines; Vol. XXXI, Part 3, 1922; Blanche River Area. By A. G. Burrows and P. E. Hopkins.
- New South Wales, Department of Mines, Geological Survey, Bull. No. 1—Tin. By E. J. Kenny.
- Mineral Resources No. 31—Notes on Petroleum and Natural Gas, and the Possibilities of Their Occurrence in New South Wales. By Leo J. Jones.
- Department of Mines, Sydney—Records of the Geological Survey of New South Wales. Vol. X, Part II: 1922.
- Secretaria de Industria, Comercio y Trabajo. Boletín Minero, Tomo XIV, Numero I; Julio de 1922. Mexico.
- State of Illinois Geological Survey, Extract From Bulletin No. 43—Geology of Northeastern Adams County. By Louis W. Currier.
- Handbook of Indiana Geology of the Department of Conservation, Division of Geology, Indianapolis.
- Michigan History Magazine, Vol. VI, No. 4, 1922.
- State of Nevada Biennial Report of the State Mine Inspector; 1921-1922.
- Commonwealth of Pennsylvania:
- Bulletin No. 55—Coal Beds in Beaver County, Pa. By J. D. Sisler.
- Bulletin No. 58—Potash Fiasco in Tioga County, Pa. By R. W. Stone, and Simple Tests for Potash. By W. B. Hicks.

- Bulletin No. 59—Bog-Iron Ore. By J. Ross Corbin.
 Bulletin No. 60—Geologic Structure of the Pittsburgh Quadrangle, Pa. By M. E. Johnson.
 Thirty-second Report of the State Mine Inspector for the State of South Dakota.
 Annual Report for the State Geologist of South Dakota, 1920-1922.
 Circular No. 9—The Possibilities of Oil in Western Dewey County. By Freeman Ward and Roy A. Wilson.
 Bulletin No. 2—The Geology of a Portion of the Badlands. By Freeman Ward.
 State of Washington, Division of Geology, Bulletin No. 27—Iron Ores, Fuels and Fluxes of Washington. By Solon Shedd, Olaf P. Jenkins, Herschel H. Cooper.

Societies and Educational Institutions.

- University of California Publications, Department of Geological Sciences. Vol. 13, No. 9—Geology of the San Bernardino Mountains North of San Geronimo Pass. By Francis Edward Vaughan.
 Bulletins of the University of Kansas—Science Bulletins. Vol. XIII, Nos. 10, 11, 12, 13, 14 and 15.
 Occasional Papers of the California Academy of Sciences. X—The Reptiles of Western North America. By John Van Denburgh.
 Proceedings of the California Academy of Sciences, Fourth Series—Vol. XII, No. 1—The Work Among the Birds and Mammals of the Northern Coast of California in 1921. By Joseph Mailliard.
 Vol. XII, No. 2—New Species of Hynobius from Japan. By E. R. Dunn.
 Vol. XII, No. 3—Upper Niocene Lacustrine Mollusks from Sonoma County, California. By G. Dallas Hanna.
 Proceedings of the American Philosophical Society. Vol. LXI, No. 4; 1922.
 American Petroleum Institute. Vol. III, No. 62; December 30, 1922.
 Mining and Metallurgical Society of America. December, 1922.
 The American Mineralogist. December, 1922.
 The Philippine Journal of Science. December, 1922.
 Alumni Magazine of the Colorado School of Mines. January, 1923.
 Journal of the American Peat Society. January, 1923.
 Bulletin of the Institution of Mining and Metallurgy. January, 1923.
 Proceedings of the Engineers' Society of Western Pennsylvania. November, 1922.
 Economic Geology. January and February, 1923.
 Transactions of the Institution of Mining and Metallurgy, Thirtieth Session; 1920.
 The Journal of Geology. January and February, 1923.
 Monthly Bulletin of the Canadian Institute of Mining and Metallurgy. February, 1923.

Maps.

U. S. Geological Survey Topographical Sheets:

- | | |
|----------------------------|--------------------------------|
| Altoona, Pennsylvania. | Schoolcraft, Michigan. |
| Big Lake, Texas. | Tufts Ranch, California. |
| Chaney Ranch, California. | Bullard, California. |
| Childwold, New York. | Levis, California. |
| Colockum Pass, Washington. | Mendota, California. |
| Conejos, Colorado. | Clevis, California. |
| Donegal, Pennsylvania. | Herndon, California. |
| Dos Palos, California. | Malaga, California. |
| Durand, Michigan. | Reedley, California. |
| Flint, Michigan. | Englebrecht Ranch, California. |
| Friant, California. | Stokes Mountain, California. |
| Hanover, Pennsylvania. | Tumey Hills, California. |
| Harlem, Georgia. | Monocline Ridge, California. |
| Kerman, California. | Squaw Valley, California. |
| Paradox Valley, Colorado. | Sultana, California. |
| Parks Bar, California. | Wahtokey, California. |
| Pozo, California. | |

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

Architect and Engineer, San Francisco.
 Arizona Mining Journal, Phoenix, Arizona.
 Asbestos, Philadelphia, Pennsylvania.
 American Petroleum Institute, New York.
 Brick and Clay Record, Chicago.
 Cement, Mill and Quarry, Chicago, Illinois.
 Chemical Engineering and Mining Review, London, England.
 Engineering and Mining Journal-Press, New York.
 Financial Insurance News, Los Angeles, California.
 Hercules Mixer, Washington, Delaware.
 Journal of Electricity and Western Industry, San Francisco.
 Metallurgical and Chemical Engineering, New York.
 Mining and Oil Bulletin, Los Angeles.
 Mining and Engineering Record, Vancouver, B. C.
 Oildom, New York.
 Oil Weekly, Houston, Texas.
 Oil and Gas Journal, Tulsa, Oklahoma.
 Oil, Paint and Drug Reporter, New York.
 Oil Trade Journal, New York.
 Oil Age, Los Angeles.
 Oil News, Galesburg, Illinois.
 Petroleum Record, Los Angeles.
 Petroleum Refiner, Kansas City, Missouri.
 Petroleum Age, New York.
 Petroleum World, Los Angeles.
 Queensland Government Mining Journal, Brisbane, Australia.
 Rock Products, Chicago, Illinois.
 Southwest Builder and Contractor, Los Angeles.
 Stone, New York.
 Salt Lake Mining Review, Salt Lake City, Utah.
 Standard Oil Bulletin, San Francisco.
 Safety News, Industrial Accident Commission, San Francisco.
 The Record, Associated Oil Company, San Francisco.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
 Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
 Bakersfield Morning Echo, Bakersfield, Cal.
 Blythe Herald, Blythe, Cal.
 Bridgeport-Chronicle-Union, Bridgeport, Mono Co., Cal.
 California Oil World, Los Angeles, Cal.
 Colusa Daily Sun, Colusa, Cal.
 Daily Midway Driller, Taft, Cal.
 Del Norte Triplicate, Crescent City, Cal.
 Exeter Sun, Exeter, Cal.
 Georgetown Gazette, Georgetown, Cal.
 Gateway Gazette, Beaumont, Cal.
 Gilroy Gazette, Gilroy, Cal.
 Goldfield News, Goldfield, Nevada.
 Guerneville Times, Guerneville, Cal.
 Humboldt Standard, Eureka, Cal.
 Healdsburg Enterprise, Healdsburg, Cal.
 Inyo Independent, Independence, Cal.
 Inyo Register, Bishop, Cal.
 Lake County Bee, Lakeport, Cal.
 Mariposa Gazette, Mariposa, Cal.

Mining and Financial Record, Denver, Colo.
Mountain Democrat, Placerville, Cal.
Mountain Messenger, Downieville, Cal.
Nevada Mining Press, Reno, Nevada.
Oroville Daily Register, Oroville, Cal.
Oatman Mining Press, Oatman, Arizona.
Oregon Observer, Grants Pass, Oregon.
Petroleum Reporter, Etna Mills, Cal.
Plumas National Bulletin, Quincy, Cal.
Plumas Independent, Quincy, Cal.
Placer Herald, Auburn, Cal.
Sacramento Union, Sacramento, Cal.
San Diego News, San Diego, Cal.
Santa Barbara Daily News, Santa Barbara, Cal.
Shasta Courier, Redding, Cal.
Siskiyou News, Yreka, Cal.
Siskiyou Standard, Fort Jones, Cal.
Stockton Record, Stockton, Cal.
Sunset Journal, Sunset District, San Francisco, Cal.
Tuolumne Prospector, Tuolumne, Cal.
Ventura Daily Post, Ventura, Cal.
Weekly Trinity Journal, Weaverville, Cal.
Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of consumers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

Sufficient publicity has not heretofore been given to this feature of the Bureau's work, but in 'Mining in California,' a suitable medium is provided for current inquiries of this nature, and, therefore, written or verbal inquiries that come to the attention of the Bureau are summarized in each issue.

The name of the product wanted or offered, only, is published; the name of the owner of the deposit, or buyer, and other details being supplied upon request.

In writing, the reference number of the item should be given.

Mineral Products or Deposits for Sale.

- 12-14 Limestone; eighty acres in Santa Clara County, ten miles from railroad.
- 12-15 High-grade limestone and marble deposit in Siskiyou County, four miles from Southern Pacific Railroad.
- 12-16 Feldspar; Tulare County.
- 12-17 Feldspar deposit; very large; in Kern County, $2\frac{1}{2}$ miles from Southern Pacific Railroad.
- 12-18 Limestone deposits in Orange, Kern, San Bernardino, and Siskiyou counties.
- 12-19 Scheelite.
- 12-20 Flourspar; tonnage.
- 12-21 Diatomaceous earth in Monterey County, $4\frac{1}{2}$ miles from railroad.
- 12-22 Montmorillonite or "rock soap".
- 12-23 Sericite-schist (talose).

Mineral Products or Deposits Wanted.

- 13-14 Lump pumice; 1-in. to $1\frac{1}{2}$ -in. lumps and up.
- 13-15 Radio pyrite.
- 13-16 Arsenopyrite ore.
- 13-17 Witherite (barium carbonate).
- 13-18 Workable quality of slate; deposit.
- 13-19 High colloidal clay.
- 13-20 Colemanite; tonnage or deposit.
- 13-21 All minerals excepting gold and silver; especially non-metallies.
- 13-22 Magnesite; high-grade; tonnage or deposit.

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of applicants for positions and 'positions open,' received by the Bureau during each 30-day period preceding the date of publication of the Monthly Chapter is carried in each issue.

Each notice is designated by a key number, and communications sent to the Bureau in reply to any notice will be forwarded to the proper party without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss.

Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

- 11-5 Electrical or mechanical engineer. Five and one-half years' experience as draftsman, assistant engineer, and engineer in Boston, Seattle, and San Francisco. One and one-half years in the air service, U. S. Army. Age 29. Married. References. Salary wanted, \$225.
- 11-6 Civil or mining engineer. Fifteen years' engineering experience in coal mining, oil fields, railroad and building construction. Age 36; single. Salary open.
- 11-7 Mining engineer or assistant. Four and one-half years' experience mining and geology in Alaska and Idaho and as metallurgist at electric smelter, Tacoma. Age 28; single. References. Salary open.

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-two years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield; Auburn, and Redding. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks -----	-----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks -----	-----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks -----	-----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks -----	-----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks -----	-----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. By Henry G. Hanks -----	-----
**Part II, 1887, 222 pp., 36 illustrations. William Ireland, Jr. -----	-----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Ireland, Jr. -----	-----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Ireland, Jr. -----	-----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Ireland, Jr. -----	-----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Ireland, Jr. -----	-----
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Ireland, Jr. -----	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford -----	-----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford -----	-----
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper -----	-----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper -----	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper -----	.25
Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pp., paper -----	.50
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper -----	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper -----	-----
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth -----	\$2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton:	
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper -----	.65
Same, including geological map of Inyo County -----	1.25
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper -----	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper -----	.65

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper-----	\$0.50
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper-----	.65
Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper-----	.65
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:	
A general Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth-----	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper-----	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper-----	.50
Mines and Mineral Resources of Sierra County, 144 pp., paper-----	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California During 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth-----	1.75
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)-----	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, December, 1919-----	Free
January, February, March, April, May, June, July, **August, September, October, November, December, 1920-----	Free
January, February, March, April, May, June, **July, August, **September, **October, **November, December, 1921-----	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free

BULLETINS.

	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations-----	----
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations-----	----
**Bulletin No. 3. Gas and Petroleum Yielding Fermentations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps-----	----
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper. 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)-----	----
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations-----	----
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations-----	.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 9. Mine Drainage, pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations-----	----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.	-----
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations.	-----
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale.	-----
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899.	-----
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations.	-----
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations.	-----
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps.	-----
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899.	-----
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet.	-----
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet.	-----
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps.	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps.	-----
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet.	-----
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps.	-----
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet.	-----
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903. 290 pp.	-----
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet.	-----
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps.	-----
**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet.	-----
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet.	-----
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California.	-----
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps.	-----
Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kuntz. 1905, 168 pp., 54 illustrations.	.25

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map	
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet	
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps	
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps	
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907, 10 pp.	
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp.	\$0.30
**Bulletin No. 47. Mineral Production of California, by Counties. 1906, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 48. Mineral Production of California for Twenty Years, 1906, by Charles G. Yale	
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp.	
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)	1.00
**Bulletin No. 51. Mineral Production of California, by Counties. 1907, by D. H. Walker. Tabulated sheet	
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet	
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp.	
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet	
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet	
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by H. D. Walker. 78 pp.	
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps	
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp.	
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet	
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet	
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps	
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp.	
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp.	
**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp.	
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp.	
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp.	

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]-----	----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp.-----	----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations-----	----
Bulletin No. 72. The Geologic Formations of California, with Reconnaissance Geologic Map, by James Perrin Smith. 1916, 47 pp.-----	\$0.25
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin. 278 pp., 26 illustrations-----	----
Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations-----	Free
**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper-----	----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguemmn, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper-----	.50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880—1917, by E. S. Boalich. 44 pp., paper-----	Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on metallurgy and ore-dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth-----	1.56
Bulletin No. 79. Magnesite in California. (unpublished)-----	----
Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)-----	----
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)--	----
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth-----	----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper-----	Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth-----	----
Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper-----	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper-----	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper-----	----
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper-----	Free
Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leek, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth-----	\$1.25
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper-----	Free
Bulletin No. 91. Minerals of California, by Arthur S. Eakle. (in press)--	----

PRELIMINARY REPORTS.

Asterisks (**) indicate publication is out of print.

	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp. -----	----
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper-----	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper-----	Free
Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper-----	Free
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker. 1920. 102 pp. 24 illustrations. Paper -----	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper -----	----

MISCELLANEOUS PUBLICATIONS.

Asterisks (**) indicate publication is out of print.

**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp. -----	----
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp-----	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp. -----	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp. -----	----
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. -----	----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. -----	----
**Catalogue of West North American and many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 -----	----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper -----	----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper-----	Free

MAPS.

Registers of Mines With Maps.

(**) indicates out of print.

	Price
Register of Mines, with Map, Amador County -----	\$0.25
Register of Mines, with Map, Butte County -----	.25
**Register of Mines, with Map, Calaveras County -----	
**Register of Mines, with Map, El Dorado County -----	
**Register of Mines, with Map, Inyo County -----	
**Register of Mines, with Map, Kern County -----	
**Register of Mines, with Map, Lake County -----	
**Register of Mines, with Map, Mariposa County -----	
**Register of Mines, with Map, Nevada County -----	
**Register of Mines, with Map, Placer County -----	
**Register of Mines, with Map, Plumas County -----	
**Register of Mines, with Map, San Bernardino County -----	
**Register of Mines, with Map, San Diego County -----	
Register of Mines with Map, Santa Barbara County -----	.25
**Register of Mines, with Map, Shasta County -----	
**Register of Mines, with Map, Sierra County -----	
**Register of Mines, with Map, Siskiyou County -----	
**Register of Mines, with Map, Trinity County -----	
**Register of Mines, with Map, Tuolumne County -----	
Register of Mines, with Map, Yuba County -----	.25
Register of Oil Wells, with Map, Los Angeles City -----	

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

Map of California, Showing Mineral Deposits (50 x 60 in.)—	
**Mounted -----	
**Unmounted -----	
Map of Forest Reserves in California—	
Mounted -----	\$0.50
**Unmounted -----	
**Mineral and Relief Map of California -----	
**Map of El Dorado County, Showing Boundaries, National Forests -----	
**Map of Madera County, Showing Boundaries, National Forests -----	
**Map of Placer County, Showing Boundaries, National Forests -----	
**Map of Shasta County, Showing Boundaries, National Forests -----	
**Map of Sierra County, Showing Boundaries, National Forests -----	
**Map of Siskiyou County, Showing Boundaries, National Forests -----	
**Map of Tuolumne County, Showing Boundaries, National Forests -----	
**Map of Mother Lode Region -----	
**Map of Desert Region of Southern California -----	
Map of Minaret District, Madera County -----	.20
Map of Copper Deposits in California -----	.05
**Map of Calaveras County -----	
Map of Plumas County -----	.25
**Map of Trinity County -----	
Map of Tuolumne County -----	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles -----	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin -----	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted -----	2.50

OIL FIELD MAPS.

These maps are revised from time to time as development work advances and ownerships change.

	Price
Map No. 1—Sargent, Santa Clara County-----	\$0.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos-----	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc-----	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield-----	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello-----	.75
Map No. 6—Salt Lake, Los Angeles County-----	.75
Map No. 7—Sunset and San Emido and Kern County-----	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County-----	.75
Map No. 9—North Midway and McKittrick, Kern County-----	.75
Map No. 10—Belridge and McKittrick, Kern County-----	.75
Map No. 11—Lost Hills and North Belridge, Kern County-----	.75
Map No. 12—Devils Den, Kern County-----	.75
Map No. 13—Kern River, Kern County-----	.75
Map No. 14—Coalinga, Fresno County-----	.75
Map No. 15—Elk Hills, Kern County-----	.75
Map No. 16—Ventura-Ojai, Ventura County-----	.75
Map No. 17—Santa Paula-Sespe Oil Fields, Ventura County-----	.75
Map No. 18—Piru-Simi-Newhall Oil Fields-----	.75
Map No. 19—Arroyo Grande, San Luis Obispo County-----	.75
Map No. 20—Long Beach Oil Field-----	.75
Map No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties-----	.75
Map No. 22—Portion of District 3, Showing Oil Fields, Santa Barbara County-----	.75
Map No. 23—Portion of District 2, Showing Boundaries of Oil Fields, Ventura County-----	.75
Map No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties-----	.75
Map No. 25—Kern River Oil Field-----	.75
Map No. 26—Huntington Beach Oil Field-----	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the State may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the State. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALI- FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the state mineralogist, as well as that of his technical staff, is also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily.

Saturday, 9 a.m. to 12 m.

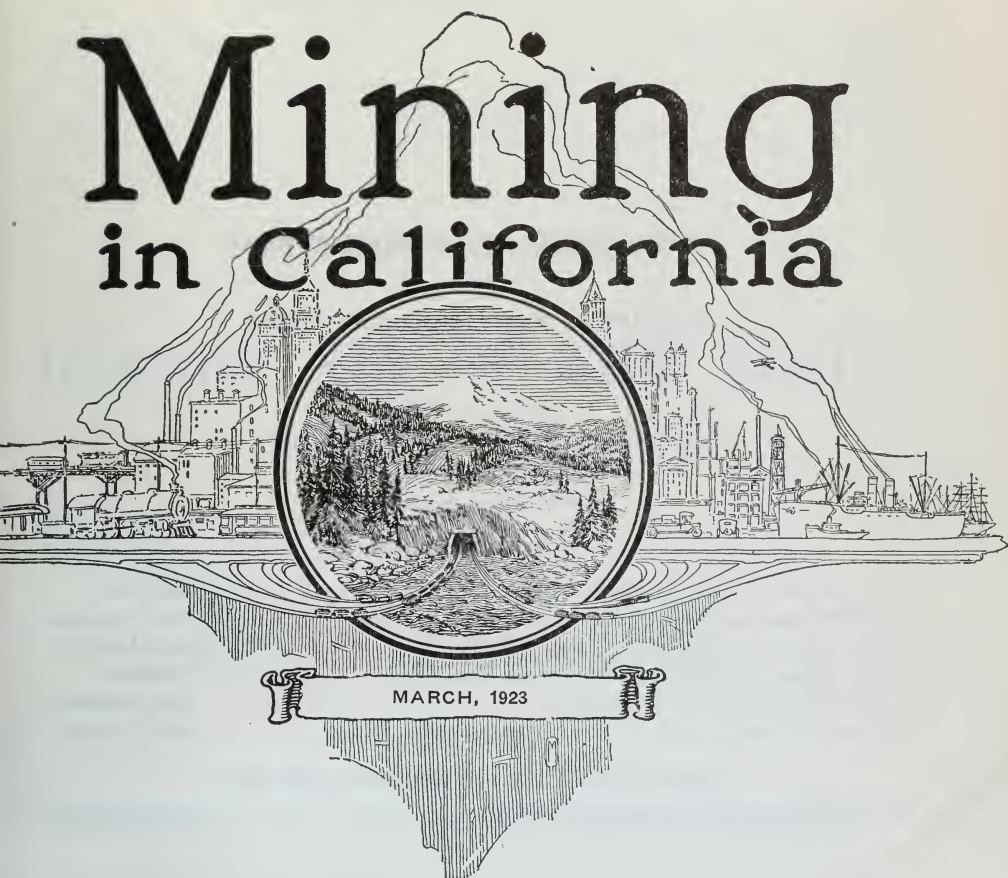
LLOYD L. ROOT,

State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.

Branch Offices: Pacific Finance Building, Los Angeles; Bakersfield, Taft, Coalinga, Santa Maria, Santa Paula, Redding, and Auburn.

Mining in California



MARCH, 1923

PUBLISHED MONTHLY BY
CALIFORNIA STATE
MINING BUREAU

FERRY BUILDING
SAN FRANCISCO

CALIFORNIA STATE MINING BUREAU

EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT
State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	-	-	-	-	Auburn
C. McK. LAIZURE, District Mining Engineer	-	-	-	-	-	-	San Francisco
M. A. NEWMAN, District Mining Engineer	-	-	-	-	-	-	Los Angeles
W. BURLING TUCKER, District Mining Engineer	-	-	-	-	-	-	Redding
CHAS. S. HALEY, Mining Engineer	-	-	-	-	-	-	San Francisco
FRANK SANBORN, Mineral Technologist	-	-	-	-	-	-	San Francisco

DEPARTMENT OF PETROLEUM AND GAS

R. E. COLLOM, State Oil and Gas Supervisor	-	-	-	-	-	-	San Francisco
--	---	---	---	---	---	---	---------------

NOTE.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 19

MARCH, 1923

No. 3

MONTHLY CHAPTER OF
REPORT XIX OF THE STATE
MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE

FRANK J. SMITH, Superintendent

SACRAMENTO, 1923

CONTENTS.

	Page
PREFACE	88
DISTRICT REPORTS OF MINING ENGINEERS	89
Redding Field Division.....	89
Auburn Field Division.....	94
San Francisco Field Division.....	97
Los Angeles Field Division.....	97
Oil Field Development Operations.....	101
SPECIAL ARTICLES	103
Notes on Peat and its Occurrence in California.....	103
SECRETARY'S OFFICE	108
DIVISION OF MINERALS AND STATISTICS.....	111
Statistics	111
Aluminum	111
Antimony	112
Arsenic	112
Barytes	113
Bismuth	114
Cadmium	114
Cobalt	115
Graphite	115
Infusorial and Diatomaceous Earths.....	116
Lithia	118
Magnesite	119
Mica	125
Molybdenum	125
Nickel	126
Museum	126
Laboratory	127
LIBRARY	128
PRODUCERS AND CONSUMERS	132
Mineral Products or Deposits for Sale.....	132
Mineral Products or Deposits Wanted.....	132
EMPLOYMENT SERVICE	133
BUREAU PUBLICATIONS	I

OUTLINE MAP OF CALIFORNIA

SCALE



- Mining Division Boundaries.
● Mining Division Offices.

M E X I C O

PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive forward step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922.

A monthly publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff are included. Mineral production reports formerly issued as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance are reported monthly. The assistance formerly given to producers and consumers by consultation or correspondence only, is also proffered through this medium.

While current activities of all descriptions will be reported in these Chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added to that list in the future as they are completed.

The Chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful latent resources of the State of California.

'Mining in California' is sent without charge to those on the Bureau's exchange list and to all others who make written or verbal request.

Pages are numbered consecutively throughout the year and an index to the complete reports will be included annually in the December number.

ANNOUNCEMENT.

In future, the publication of 'Mining in California' will be quarterly instead of monthly, and the next issue will be dated July, 1923. We find this action necessary principally owing to lack of available funds to meet the cost of printing.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each division working out from a local branch office.

This move brought the Bureau into close personal contact with operators, but did not materially shorten the time between the gathering of data in the field and their publication in the Report of the State Mineralogist at the end of an annual or biennial period.

Mining activities and development noted by district engineers in their respective fields are now embodied in monthly reports published in each issue of 'Mining in California,' thus making these data available within a maximum period of thirty days, and the Monthly Chapter as far as possible a compendium of current mining progress throughout the State.

The counties included in each field division and the location of the local offices are shown on the accompanying outline map of the State. (Frontispiece.)

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the State's oil fields is included under this heading.

REDDING FIELD DIVISION.

W. BURLING TUCKER, Mining Engineer.

Shasta County.

COPPER MINES.

Arps Group of Mines is located in sections 20, 21, 28 and 29, T. 34 N., R. 3 W., one and one-fourth miles north of Copper City, in the Pittsburg Mining District. It comprises fifteen patented claims, totaling 250 acres, adjoining the Copper City claims of the Shasta Zinc and Copper Company. Owners are William Arps and R. M. Saeltzer of Redding. Elevation 900 to 1200 feet. The property is located on the Copper City lode; the shear zone in which this lode occurs traversing the Bully Hill rhyolite and having a general course of N. 30° W. The ore is pyrite, sphalerite and chalcopyrite with barite as a gangue. Developments consist of six tunnels, two shafts and several crosscuts and winzes, aggregating over 3000 feet. The most extensive workings are confined to the Globe, Hearst and Kaiser Wilhelm claims, as follows: No. 1 tunnel on the Globe claim is 120 feet long, coursing N. 45° E. Seventy feet from the portal a winze has been sunk 25 feet deep and crosscuts run east and west. A streak of ore was developed which is said to have assayed \$40 gold, 5 per cent copper and 400 ounces in silver. No. 2 tunnel, which is located on the Globe claim, is a shallow tunnel 450 feet in length, course S. 55° W. for 100 feet, then east 360 feet. Some streaks of ore were developed that are reported to have carried high values in gold and silver.

Shaft No. 1, which is located near the southeast end of the Globe claim on Baxter gulch, was sunk to a depth of 50 feet, developing a lens of ore 8 feet wide, which is evidently the same ore body as was

developed in the Baxter shaft on the Baxter claim, owned by the Shasta Zinc and Copper Company. The ore extracted from this shaft is reported to have assayed 6 per cent copper, with \$28 in gold and silver values.

Some 200 feet northwest of this shaft there is a massive outcrop of iron, which shows a heavy percentage of iron pyrite. The course of this outcrop is northwest and dip about 50 degrees to the southwest.

No. 3 tunnel is on the Hearst claim and trends a little east of north, about 200 feet. Four crosseuts from 30 to 50 feet in length were driven to the east of these workings.

The third crosscut shows 26 feet of low grade ore, which is reported to carry \$6 in gold and 9 ounces in silver.

No. 4 tunnel, which is located on the Kaiser Wilhelm claim, is a crosscut tunnel driven N. 40° E., 500 feet. At 100 feet from the portal it cut a series of parallel fissures with strike N. 30° W. and dip 50 degree southwest showing ore carrying chalcopyrite, sphalerite, and pyrite. Several small lenses of ore were developed about 10 to 30 feet in length, and from 2 inches to 3 feet in width.

On the surface above No. 4 tunnel and about 150 feet south of No. 5 tunnel, in an open cut there is exposed 15 feet of sulphide ore, which occurs along the main shear zone.

No. 5 tunnel, which is located on the north end of the Kaiser Wilhelm claim, is driven N. 40° E., 400 feet. At a distance of 175 to 200 feet from portal it cut a lens of low-grade ore, containing galena, chalcopyrite, sphalerite and pyrite. On the surface about 100 feet above this tunnel, the shear zone is well-defined, having a general course of N. 30° W. dip 60 degrees southwest. Ore was mined at this point by open cuts and shallow tunnels, which is said to have carried high gold and silver values.

Several cars of ore have been shipped from the property to the Mammoth smelter at Kennett and are reported to have averaged \$20 per ton in gold and silver values.

Equipment consists of blacksmith shop and tools, compressor-house, Chicago pneumatic compressor, air drills, cars and track. Idle.

Bibliography: State Mineralogist's Report XIV, p. 761, Bulletin No. 50, p. 110.

Colma Copper Group of Mines, located in sections 6 and 31, T. 33 and 34 N., R. 5 W., 6 miles west of Kennett, in the Backbone Mining District. It lies between the Uncle Sam and Mammoth holdings, at an elevation of 2400 feet. Owners are, M. E. Dittmar, of San Francisco, and Louis Monahan of Winthrop, California. The property is under bond to the American Zinc, Lead and Smelting Company, 1012 Pierce Bldg., St. Louis, Missouri. C. B. Nichols, superintendent.

This group of claims is being developed through No. 5 tunnel level of the Uncle Sam mine in hopes of picking up the direct extensions of the Mammoth mine ore trends, along the so-called 'California fissure' or shear zone. The trend of the tabular ore deposition has been developed in the Mammoth mine, from the point of original exposure for a distance of approximately 5000 feet through the Mammoth property towards the Colma Copper boundaries.

This is a very interesting piece of development work, and the logical point for further and deeper development of the Mammoth ore bodies.

Twelve men are employed in driving the main crosseut tunnel, which has been driven about 2600 feet.

Shasta May Blossom Mine, is located in section 14, T. 34 N., R. 3 W., one mile north of Winthrop, in the Pittsburg Mining district, and comprises twenty-six unpatented claims, known as the Keith group. Owners are Shasta May Blossom Mining and Smelting Company, C. M. Bradley, president; E. Seaburg, secretary. Offices, 604 Mills Building, San Francisco.

The property is located along the contact of Bully Hill rhyolite and black and gray shales, the latter being the footwall. The top of the mountain is capped with rhyolite, and on the east slope of the ridge are gossan croppings.

On the east slope of the ridge at an elevation of 1250 feet the main working tunnel has been driven N. 50° W., 720 feet, then due north 26 feet. The formation passed through in these workings is meta-andesite. At 320 feet from the portal, a drift has been run S. 70° W., 120 feet. In this drift a winze has been sunk to a depth of 18 feet. It is reported a small lens of ore was developed in the winze which is said to have carried high values in gold and silver. On the surface above this tunnel near the top of the ridge, there are gossan croppings about 160 feet in width. North of this tunnel at an elevation of 1350 feet, what is known as the Porter tunnel is driven due west 600 feet, and at 250 feet from the portal of the tunnel, a raise was run to the surface, a distance of 100 feet, and connected with a tunnel from the west slope of the ridge. It is reported that a shoot of ore was developed in this raise, about 40 feet in length and from four to six feet in width, which was said to carry 6 per cent copper and \$8 in gold and silver. On the slope of the ridge south of this tunnel there is a body of gossan croppings, probably 60 feet wide. On what is known as the Kitchen claim, about the center of this group of claims, north of the above mentioned workings, there is a shallow tunnel 80 feet long, which developed a lens of sulphide ore, the general course of which is N. 20° E., dip 35 degrees east. The lens is 50 feet in length, and 8 feet wide. Ore is principally iron pyrite, with small amount of chalcopyrite. Last work on the property was done in January, 1921, when the company sunk a drill hole from the surface which connected with a drift from the lower tunnel, the depth of the hole being 170 feet. No ore was developed.

Equipment consists of Ingersoll-Rand, size 7 shot drill, and Domestic 9-h.p. gas engine, Rix compressor, driven by 50-h.p. General Electric motor, blacksmith shop, compressor building, bunk house, 1000 feet 3-inch air line, cars and track. It is reported that the company is planning to resume operations this summer.

Bibliography: State Mineralogist's Report XIV, p. 772, Bulletin No. 50, p. 100.

HORSE MOUNTAIN COPPER DEPOSITS.

Near the summit of Horse Mountain, west of the Bully Hill District, is an interesting occurrence of native copper, very small particles of which are scattered through a mass of altered igneous material chiefly of volcanic breccia or conglomerate of silicious lavas. Farther southwest, near the head of Potter Creek, a number of prospects show small lenses of copper ores, but as yet no considerable ore bodies have been

disclosed. The ore occurs along east and west fractures along epidote dikes which occur in the Dekkas andesite on the western slope of Horse Mountain. The ore is chalcopyrite associated with iron pyrite in quartz gangue, and carried values in gold and silver. The most extensive showing of ore in the district has been on the Shasta Belmont group of claims.

Minnie Haley Group of Mines, is located on the west slope of Horse Mountain in Section 24, T. 34 N., R. 4 W., $1\frac{1}{2}$ miles northeast of Heroult. Elevation 1800 to 2000 feet. Owners are James Doyle, C. M. Allison of Copper City and George G. Dean of Redding. Holdings consist of eight unpatented claims.

Developments consist of four tunnels from 20 to 150 feet in length. At an elevation of 1800 feet a crosscut tunnel is being driven east 200 feet to cut an ore fissure bearing N. 50° E., which has been developed by a short tunnel 20 feet in length about 300 feet in elevation above this tunnel. In this short tunnel two feet of ore has been exposed, carrying bornite, chalcocite, chalcopyrite and some pyrite in a quartz gangue. On Minnie Haley No. 2 claim, there is a dike of epidote 8 to 15 feet wide, which strikes N. 80° E. and dips vertical. A tunnel has been driven east along this dike 160 feet. At 50 feet from the portal it cut a fracture which strikes N. 30° W., which was drifted on 30 feet to the northwest, developing 8 inches to 12 inches of ore. Near the face this tunnel cut another ore streak about 12 inches wide, which has a course of N. 50° E. Samples taken from these two ore showings are said to have assayed from 4 to 10 per cent copper, 5 to 10 ounces silver, and from \$2 to \$8 in gold.

To the north on the contact between the McCloud limestone and the shales of Nosoni formation, a tunnel has been driven 100 feet on a contact of limestone, and then 75 feet southeast in the shales but no ore has been developed on the contact. North of these workings in the limestone, some ore was developed on a N. 50° W. fissure. Shaft 20 feet deep. Two men employed on development work.

Shasta Belmont Group of Claims, formerly known as *Graham Group*, consists of nine unpatented claims, located in Sec. 24, T. 34 N., R. 4 W., $1\frac{1}{2}$ miles northeast of Heroult. Elevation 1850 feet. Owner W. E. Casson of Carson City, Nevada.

Developments consist of two tunnels driven east along an east and west fracture. The lower tunnel was driven N. 60° E., and then 350 feet east and there is a raise on ore from this level 50 feet to an upper tunnel. The upper tunnel is driven N. 50° E., 75 feet, then drifted 150 feet east along an ore bearing fissure. The ore developed was from 6 inches to 2 feet wide, and was stoped for about 50 feet in length. Ore is chalcopyrite, chalcocite, and pyrite in a quartz gangue. Three cars of ore were shipped from the property in 1915 to the Mammoth Smelter at Kennett. Idle.

Kane and Wilburn Group. Two unpatented claims in Sec. 24, T. 34 N., R. 4 W., $1\frac{1}{2}$ miles northeast of Heroult. Owners are Frank Kane and Archie Wilburn of Heroult. Elevation 1600 feet. A deposit of magnetite, with pyrrhotite, chalcopyrite and pyrite occurs in Dekkas andesite. The general course of the deposit is N. 50° E., and it is from 6 to 10 feet in width. Developments consist of a shaft 40

feet deep sunk on the outcrop and northwest of this shaft a crosscut tunnel driven north 50 feet, and a drift driven 200 feet southwest on ore. Idle, only assessment work being done on the property.

GOLD MINES.

Gold Bar Mines. This property comprises four unpatented claims, known as: Gold Bar No. 1, Gold Bar No. 2, Gold Bar No. 3, and Gold Bar No. 4, located in sections 22 and 26, T. 33 N., R. 5 W., 10 miles north of Redding, in the Churn Creek Mining district. Elevation 1600 feet. Owners are Frank O. Hollingsworth and Dr. G. A. Grotefend of Redding. The mine has not been worked since 1891, when ore was mined and hauled to the National Mill, where it is reported to have milled \$50 per ton. The property has been idle since that time, and was relocated in January, 1923. A vein of quartz four feet wide occurs in the meta-andesite, general course N. 30° W. and dip 55 degrees to the southwest. The outcrop of the vein can be traced for 6000 feet.

Developments consist of three tunnels driven on the course of the vein. The two lower tunnels are caved, but from the indications ore was stoped from the lower tunnel to the upper tunnel. The vein has been drifted on in the upper tunnel for 100 feet, developing an ore shoot 80 feet in length, and 4 feet in width. Samples taken from this vein are reported to assay from \$10 to \$15 per ton in gold. A raise from the intermediate tunnel connects with this tunnel, distance 30 feet. The present locators have two men employed cleaning out old workings, and are planning to drive a tunnel on the vein at a lower elevation.

Siskiyou County.

On the *Souza Ranch*, owned by George Souza, near Yreka, it is reported that in prospecting on the property, a vein of quartz has been developed, which carries values in tungsten, and also some veins carrying values in copper, zinc and gold.

H. J. Barton of Yreka, who is interested in a large deposit of limestone near Gazelle, is reported to have discovered some marble of good quality on the property.

H. M. Balfrey and *Thomas Park* of Yreka are reported to have discovered a deposit of tin ore in the East Fork Mining District, along the Siskiyou-Trinity County line, near Kangaroo Lake. A number of locations have been made, known as the *Kangaroo Group of Claims*.

On the *Rainbow Group of Claims*, located near Hawkinsville it is reported *Newton Gordon* and *T. C. Quinn* of Hawkinsville recently developed a vein of rich gold-bearing ore. The owners are planning to do an extensive amount of development on the property this summer.

There is a considerable amount of activity in placer mining at Hawkinsville this spring.

Tehama County.

The property of the *Tuscan Oil Company*, located six miles north of Red Bluff was recently sold at sheriff's sale to *Chas. H. Wood* of San Francisco. When the company suspended operations the well was down 1700 feet.

Trinity County.

The Rebel Mine, located six miles up the South Fork of Trinity River from Forest Glen, in Sec. 31, T. 29 N., R. 12 W. Holdings consist of three claims, owner Jack Hoffman of Forest Glen. A vein of sulphide ore 4 feet wide has been opened up along a contact of black slate and quartzite. The ore is chalcopyrite associated with iron pyrite in quartz gangue. Samples taken from the vein assay 2 per cent copper with gold and silver values. A shaft is being sunk on the vein.

Precious Twins Placer Mine, located in Sec. 17, T. 4 N., R. 6 E., 12 miles north of Hyampom on the South Fork of the Trinity River, is being operated by Frank Lynch of Hyampom. Holdings consist of 200 acres. Two men are employed.

AUBURN FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

Amador County.

The immense undeveloped clay resources of this county continue to be exploited in a small way and from time to time new pits are opened. The thousands of acres of potential clay land in the Ione-Carbondale district have never been systematically drilled, probably because the demand for clay has not been great enough yet to put any tax upon the areas known to be good clay land and already opened. The fact that so much of the land has been under one ownership may also have had some effect upon progress in this direction.

The following clay working establishments have in late years been buying part, and in many cases all, of their clay in this district. The list indicates the wide variety of uses to which the clays of the district are adapted.

Manufacturers using clay from the Ione-Carbondale district:

California Pottery Company, Oakland.

N. Clark and Sons, Alameda.

Craycroft and Knight, Fresno.

Gladding, McBean and Company, Lincoln.

Livermore Pressed Brick Company, Livermore.

Muddox Pottery Company, Sacramento.

Oakland Art Pottery Company, Oakland.

Pacific Porcelain Ware Company, Richmond and San Pablo.

Richmond Pressed Brick Company, Richmond.

West Coast Porcelain Company, Millbrae.

Ione Firebrick Company, Ione.

Furlong-Poxon Pottery Company, Vernon.

Los Angeles Pressed Brick Company, Los Angeles.

Stockton Fire and Enamel Brick Company, Stockton.

Garden City Pottery Company, San Jose.

Pacific Coast Pottery and Terra Cotta Company, San Jose.

No absolutely white-burning clay has been developed in the district yet. Some clays have been produced by washing and settling that are pure white before burning, but still contain a fraction of one per cent of iron oxides, enough to give a light straw color on burning, and these have been used for heavy hotel ware and porcelain. From this color the

clays range through various shades to a strong mottled red, which burns red and is used for tiling. Much of the white clay is nearly half quartz sand, giving low shrinkage and low absorption and a fusibility over 3000 degrees, and these qualities make it a good fire clay, eminently suited for fire brick. This sandy clay runs about 70 per cent silica, 20 per cent alumina, $1\frac{1}{4}$ per cent iron oxides, 0.3 per cent CaO, and 0.2 per cent MgO. Other samples where the proportion of sand is lower run up to 34 per cent alumina and correspondingly less silica, but in general are claimed to be typically low in lime. Occasionally pits have been started in low ground that had to be abandoned on account of gypsum seams in the clay, but these are erratic in occurrence.

The use of sand from these white clays for making glass was the result of war conditions which shut off supplies of foreign glass sand. With large contracts to fill, a large glass company took over a plant at Antioch and shipped in 1918 nearly 15,000 tons of clay-sand from Carbondale to the plant, where the sand was washed. The demand ceased when the cheaper Belgian glass sand could be had again.

The mining and hauling of the clay is cheap here even with the present small-scale operations, and freight rates to the principal markets around San Francisco bay are low. A broad-gauge railroad traverses the clay belt, making the haul from the pits to the loading stations short. Laborers in the pits receive \$3.50 a day and specially trained men more. A soil and sand overburden generally has to be removed, varying in thickness from a few inches up to 20 feet, but where this is too thick the clay may be mined by wide, high drifts with pillars. Most of the work has been done by hand, but there is one steam shovel in use. Thirty per cent dynamite is used for blasting. Detailed cost figures cannot be shown as the business is closely competitive.

Changes since our report of 1920, entitled 'The Clay Industry in California' have been noted during a visit made this month.

Amador Kaolin Co. is no longer operating. This was a subsidiary of the *Illinois Pacific Glass Co.* and mined a large quantity of sandy clay during the war. The sand was washed in a plant at Antioch and used for glass. The market collapsed as soon as the Belgian sand imports could be resumed. The foreign sand is said to be mined in large quantity at very low cost, requires no treatment, and even in its crude condition is claimed to be superior to the local washed product.

W. D. Amick Property, formerly operated under lease by the Philadelphia Quartz Company, is idle since the company quit the production of domestic sand. They worked this property about three years, mining the clay-sand and washing it in the plant described in our bulletin, 'The Clay Industry in California,' and using the sand in the manufacture of sodium silicate. They have lately sold their mining equipment and are said to have returned to the use of Belgian sand.

Bacon and Bacon. Mark J. Bacon, manager, Ione. They do a general clay mining and shipping business. They employ 15 to 20 men and supply a variety of clay to a number of plants. The products made from these clays are diversified, including pressed and fire brick, architectural terra cotta, building tile, high-grade pottery, sewer pipe and porcelain ware. The clays range in color from the white clay-sand to a strong red mottled clay. This firm owns some clay land near Carbon-

dale, works other clay pits under lease and mines clay in some cases under contract for the owners and consumers. They have lately bought the mining equipment of the Philadelphia Quartz Co., including a steam shovel, and have moved it to Carbondale.

Mrs. W. W. Carlile Property near Ione contains a deposit of fine white clay and sand. It is undeveloped.

N. Clark and Sons own about 200 acres in the clay belt near Carbondale, from which they obtain high-grade clay for their pottery at Alameda. Clay is mined under contract for them by Bacon and Bacon.

Ione Firebrick Company continue operation of their plant near Ione for the manufacture of fire brick. A crew of nine or ten men are employed. The kilns are in operation most of the year, but the season for making bricks begins about March 15. They make about 20,000 bricks a day for eight months, and the kilns have a capacity of about 11,000 bricks a day, leaving 9000 a day to store for winter. The product is of good quality and finds a market anywhere in the Pacific Coast region where freight rates are favorable. Wm. Brown is manager.

Livermore Pressed Brick Company is planning to open a new clay pit on the J. M. Fancher property, about 4 miles from Ione, to supply their plant at Livermore. H. L. Bramwell is in charge.

McKissick Cattle Company owns a grant called Rancho Arroyo Seco, containing some 33,000 acres of land in the Ione-Carbondale clay and lignite belt, and mineral rights under several thousand acres more. Much of this land is known to be underlain by valuable clay deposits, but it has not been adequately drilled, so the full extent of the deposits is not known. The quality of the clay is also, therefore, an uncertain factor. Many of the firms using clay from this district get it from this property.

Newman Clay Company of Ione is employing 13 men at present (March 10) at its clay pits a mile from Ione at Newman Siding. This company digs white fire clay for sale to potteries and brick makers and has built up a good business from a small beginning. Where the overburden is heavy compared to the minable clay stratum, the latter has been worked by a system of wide drifts and pillars, but where the overburden is thin it is stripped by hand. The thickness of the workable layer of clay varies from 15 to 45 feet and it is underlain by a black stratum suggesting the proximity of lignite, though the latter has not been exposed here.

Philadelphia Quartz Company. Idle. See W. D. Amick property, *ante*.

COAL.

John Mocine is in charge of drilling operations on the Rancho Arroyo Seco, owned by the McKissick Cattle Company and taking in much of the country around Ione and Carbondale. The names and plans of those financing the drilling have not been divulged. An auger drill rig is being used and four men are employed. The drilling is being done for the avowed purpose of prospecting the lignite known to underlie the property and which has been mined in a small way by shafts and

drifts. It is the first comprehensive prospecting of this tract which contains about 33,000 acres, a considerable part of which will be drilled. The work already done has begun to shed new light upon the geology of the tract, according to Mocine. It has been thought in the past that the lignite occurred in relatively small deposits, in a chain of depressions once occupied by marshy lakes. Mocine thinks the present drilling is beginning to show that these basins are larger than supposed, or that the structure of country is monoclinal with the strata dipping gently toward the valley and with the coal much more widely distributed than previous operations indicated.

All of the holes so far drilled up to March 10 are said to have shown a good thickness of coal, the entire thickness of lignite stratum ranging from 21 to 30 feet, of which about 12 feet are classed as heart coal. The holes range from 15 to 40 feet deep on the upper edge, increasing to 81 feet deep 3000 feet westward. The property is thought to have interesting possibilities for a well financed company. A few years ago tests of the lignite in the district showed that it yielded up to 62 gallons of oil and 18 pounds of ammonium sulphate per ton, by destructive distillation and according to Mocine samples coming from the present drill holes are comparing favorably with these figures. Should the drilling show sufficient lignite, there are possibilities of a big new industry for the county. Incidentally, this prospecting is affording a great deal of new information about the extent and character of the clay beds in the rancho. Should the lignite ever be exploited in a large way by stripping, an immense amount of clay will be made available at very low cost.

The high yield of oil from this lignite raises very interesting questions as to the genesis of the oil. The lignite shows plainly its derivation from coniferous trees, the partly changed wood and fragments of unchanged bark being very common. When wet it has a clayey appearance but dries to a brittle and easily broken mass that will not stand transportation well. Good briquettes can be made from it, some having been made in a plant put up years ago. These are said to have been made without adding any binder.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

Inquiries handled in the San Francisco office during the past thirty days indicate that mining conditions in this district continue to improve.

This is particularly true of quicksilver operations, gold quartz mining in Mariposa County, and among the magnesite and other structural and industrial mineral producers; however, as no field work was undertaken, detail reports must be deferred until an opportunity is found to confirm reported activities by personal visit.

LOS ANGELES FIELD DIVISION.

M. A. NEWMAN, Mining Engineer.

Kern County.

The Standard Consolidated Gold Mining Company, which owns the old *Exposed Treasure Mine*, situated 5 miles south of Mojave, is running a crosscut tunnel to cut the *Exposed Treasure* and other veins

at depth, and also unwater the old mine workings. This work has been under the direction of Consulting Engineer, D. B. Myers. In view of the large production of the Exposed Treasure Mine in the past, this piece of exploration work is well warranted. If commercial ore is encountered, the Mojave District will become the center of much activity.

The discovery of the Yellow Dog Mine a little over a year ago, which lies but a short distance from the Exposed Treasure Mine, has attracted considerable attention to the camp.

Los Angeles County.

Amargosa Talc Company. This company has just completed and put into operation a talc grinding plant in Los Angeles. The raw material comes from its talc mines in Death Valley. The talc is primarily to be ground and used in the manufacture of talcum powder and as a filler for paper. It is estimated it will have a capacity of 500 to 600 tons per month.

A. Getty, president; John F. Sherran, secretary; R. W. Glendenning, general manager. Office: 224 Santa Fe avenue, Los Angeles, Cal.

Catalina Island Quarry. The tremendous expansion in building and road construction in Los Angeles and vicinity is creating an increasing demand for crushed rock of good quality. To fill this need *Graham Brothers* are now opening a rock quarry near Pebbly Beach at the Isthmus on Catalina Island. The quarry is being equipped with the best machinery obtainable in the way of compressors, rock drills, conveyors and other necessary accessories to obtain minimum costs in operation. The rock will be barged direct to San Pedro and from there sent by rail to Los Angeles and adjacent points.

It might well pay land owners within reasonable distance of Los Angeles to look into the character of the rock on their holdings, for good quality of rock, sand, gravel, limestone, clay or gypsum is in much demand at present.

Magnesium Materials Company. This company has been formed for the manufacture of magnesium oxychloride, and has received a permit from the Corporation Commission to sell its preferred and common stock, in amount \$25,000.

It will maintain a factory and office at 809 North Main street, Los Angeles.

San Bernardino County.

California Rand Silver, Incorporated. At the beginning of March, this company issued its regular dividend No. 38, calling for a distribution of \$25,600, which makes a total in dividends since January 1, this year, of sixteen cents, or \$204,800..

Extraction and Advancement.

During the month of February, extraction from the mine was as follows:

Milling ore.....	6,772 tons
Shipping ore.....	800 tons
Waste	3,928 tons
Total extraction.....	11,526 tons

The total advancement in all workings in the mine during the month was 1157 feet.

Ore to the mill-----	9,163 tons
Concentrates to the smelter-----	387 tons
Ore to the smelter-----	756 tons

Of the ore milled, 2,391 tons came from the mill dump.

The Mill.

During the month of February, the daily average tonnage of the mill (28 days) was 327 tons. The daily average, running time, was 353.75 tons. The lost time during the month was 26 hours and 42 minutes, being largely due to power off, water shortage and the time necessary for repairs.

Total average value of heads for ore milled-----	\$16 32
Total average value of tails-----	1 84
Recovery per ton-----	14 48
Total recovery on 9,363 tons-----	132,698 56
Average concentrate value per ton-----	354 34
Tons concentrates produced-----	374.5
Tons concentrates shipped-----	378

At the meeting of the board of directors held March 3, it was determined to increase the company's surplus to one-half million dollars, the reasons for the increase being set forth in the following resolutions:

WHEREAS, When the provisions of the Pittman Act shall have been complied with, which will probably be in the late fall or early winter of this year, the price of silver, according to the best authorities, will greatly decrease; and

WHEREAS, It may be advisable in the ensuing year for the company to be in a position to hold its silver bullion from time to time in order to take advantage of the best prices, the fluctuations of the market considered; and

WHEREAS, Where the income tax for this corporation, payable in 1924 and based upon production in 1923, will be as heavy as in former years, the earnings of the corporation for the said year 1924 bid fair to be greatly reduced because of the lessened price of silver; and

WHEREAS, A considerable additional sum may be due the government under adjustment of our income taxes for 1919, 1920 and 1921; and

WHEREAS, An experimental one-ton reduction plant is now in operation which it is hoped and believed will demonstrate that it will be possible to reduce our concentrates to bullion, thereby saving heavy smelting and shipping charges, in which event a twenty-ton reduction plant will be required, the cost approximating \$75,000; therefore, be it

Resolved, That to meet these conditions, possible and certain, a largely increased surplus at the close of this year will prove most advantageous to the future successful conduct of the business of the corporation, it is therefore ordered and directed that, beginning with this date, the monthly earnings of the company, over and above the sum required to meet the regular monthly dividends, shall be applied to the surplus until such fund shall have reached the sum of \$500,000.

Financial.

Returns from the smelter for the month total \$178,462.73.

After paying this dividend, meeting the month's expenses, and paying \$30,000 on income tax, the company has a cash balance of \$294,450.36, an increase in surplus over last month of, roundly, \$40,000.

The Copper Basin Consolidated Mines Company, with large holdings in Copper Basin, at Monumental Peak, is preparing for continuous operations.

The property is located eleven miles north of Drennan, a station on the Parker cut off of the Atchison, Topeka and Santa Fe Railway on the Colorado River.

Installation of a new hoist on its 300-foot incline shaft has just been completed.

The company claims to have a vein of copper sulphide ore 8 feet wide, which will average 6 per cent copper. It is the intention to mine and ship this ore to the Humboldt smelter. Besides ore of a shipping grade, there is a considerable tonnage of low grade copper ore for which a plant will be built in the future.

J. L. Curtis, of Los Angeles, is president and Jas. C. McDowell, superintendent of the company. Main office: Lankershim Building, Los Angeles.

San Diego County.

The Duralite Company, Incorporated, has recently acquired control of the International Magnesium Products Company, whose plant is located at Chula Vista. This plant, which has now been idle for over a year, has been equipped with new machinery and will have a production of 400 to 500 tons per day of magnesite building products. The magnesite used is obtained from deposits in Lower California. The company has a field in which it can expand its operations to large proportions, as there appears to be no slowing down of the building program in southern California.

President, Dr. C. S. de Mey; Secretary and General Manager, Mr. Swartz.

General office: Marsh-Strong Building, Los Angeles.

The General Petroleum Company is reported to have purchased 640 acres of otalite deposits from R. E. Harrison of San Diego. It will use the otalite in the refining of its oils. The company has spent considerable time in experimental work in making this material suitable for its refineries. Otalite, as it is called locally, is in reality a variety of montmorillonite, a mineral of the clay group, carrying a large percentage of combined water, and is a hydrous silicate of alumina. It is quite soft, has a soapy feel and occurs white, grey, or pink.

OIL FIELD DEVELOPMENT OPERATIONS.

H. E. COLLOM, State Oil and Gas Supervisor.

From February 10, 1923, to and including March 10, 1923, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—					
Pacific Oil Co.-----	35	30	24	85	Elk Hills
Pacific Oil Co.-----	35	30	24	38	Elk Hills
Pan American Petroleum Co.-----	34	30	24	2	Elk Hills
Pan American Petroleum Co.-----	34	30	24	3	Elk Hills
Pacific Oil Co.-----	7	32	24	69	Midway
Pacific Oil Co.-----	5	32	24	71	Midway
Murvale Oil Co.-----	26	31	23	21-M	Midway
Section Two Oil Co.-----	2	31	22	2	Midway
Union Oil Co.-----	4	11	23	3	Sunset
Comanche Point Oil Co.-----	32	12	18	2	-----
LOS ANGELES COUNTY—					
Acme Petroleum Corp.-----	19	4	12	Damron 2	Long Beach
Big Three Oil Co.-----	30	4	12	1	Long Beach
Cannon Day Oil Syn.-----	19	4	12	1	Long Beach
D'Angelo Oil Co.-----	19	4	12	2	Long Beach
Davis & MacMillan.-----	30	4	12	4	Long Beach
Walter H. Fisher.-----	30	4	12	5	Long Beach
Fred B. Foster & Co.-----	30	4	12	46	Long Beach
Fred B. Foster & Co.-----	19	4	12	48	Long Beach
General Petroleum Corp.-----	19	4	12	Clock 3	Long Beach
George F. Getty.-----	19	4	12	Galbreath 7	Long Beach
George F. Getty.-----	19	4	12	Ingles 6	Long Beach
Harmony Rose Oil Syn.-----	19	4	12	1	Long Beach
Hub Oil Co.-----	24	4	13	Beck 1	Long Beach
Lambert Hampton Oil Syn. No. 1.-----	30	4	12	1	Long Beach
L. A. Lambert Oil Syn. No. 2.-----	30	4	12	1	Long Beach
L. A. Lambert Oil Syn. No. 3.-----	30	4	12	1	Long Beach
Mike Mikels.-----	29	4	12	2	Long Beach
E. J. Miley.-----	19	4	12	Mills 4	Long Beach
H. H. Patton.-----	19	4	12	3	Long Beach
Petroleum Midway Co. Ltd.-----	19	4	12	Bauman 1-B	Long Beach
Petroleum Midway Co. Ltd.-----	30	4	12	Ella Clark 1	Long Beach
Progressive-Burnett Syn.-----	30	4	12	1-A	Long Beach
Prudential Petroleum Co.-----	29	4	12	2	Long Beach
Queen City Oil Co.-----	19	4	12	1	Long Beach
Shallow Field Oil Co.-----	19	4	12	1	Long Beach
Shell Co.-----	29	4	12	Nesa 4	Long Beach
Shell Co.-----	29	4	12	Rose 1	Long Beach
Shell Co.-----	29	4	12	Kent-Garth 1	Long Beach
Shell Co.-----	29	4	12	Alamitos 7	Long Beach
Signal Union Syn.-----	30	4	12	Burnett	
Jos. K. Tobin.-----	30	4	12	Villa 1	Long Beach
Tucker & Johnston.-----	30	4	12	3	Long Beach
Clarence M. Turner Syn.-----	24	4	12	1	Long Beach
Weinberg Nuetzel Syn.-----	20	4	12	1	Long Beach
Western Star Oil Co.-----	19	4	12	Foster 1	Long Beach
Western Star Oil Co.-----	19	4	12	Walker 1	Long Beach
Yale Signal Hill Syn.-----	30	4	12	1	Long Beach
Union Oil Co.-----	1	2	12	La Merced 24	Montebello
Anchor Oil Co.-----	6	3	11	3	Santa Fe Springs
Are-Bee Syn.-----	7	3	11	31	Santa Fe Springs
Are-Bee Syn. No. 3.-----	7	3	11	32	Santa Fe Springs
Barnsdall Foster Co.-----	1	3	12	1	Santa Fe Springs
Coalinga Mohawk Oil Co.-----	6	3	11	Batson 3	Santa Fe Springs
Coalinga Mohawk Oil Co.-----	6	3	11	Lamb 1	Santa Fe Springs
Daly Oil Syn.-----	4	3	11	1	Santa Fe Springs
General Petroleum Corp.-----	6	3	11	Santa Fe 77-B	Santa Fe Springs
General Petroleum Corp.-----	5	3	11	Santa Fe 45	Santa Fe Springs
General Petroleum Corp.-----	6	3	11	Hill 87-A	Santa Fe Springs
George F. Getty.-----	5	3	11	Baker 12	Santa Fe Springs
George F. Getty.-----	5	3	11	Baker 11	Santa Fe Springs
Hopkins & Howland.-----	6	3	11	Baker 1-A	Santa Fe Springs
Oscar R. Howard.-----	6	3	11	Hathaway 2	Santa Fe Springs
C. C. Julian.-----	6	3	11	6	Santa Fe Springs
Luneta Oil Co.-----	9	3	11	1-A	Santa Fe Springs
Petroleum Midway Co. Ltd.-----	6	3	11	Standlee 2	Santa Fe Springs
Petroleum Midway Co. Ltd.-----	6	3	11	Weaver 3	Santa Fe Springs
Standard Oil Co.-----	31	2	11	Santa	
Standard Oil Co.-----	31	2	11	Gertrudes 3	Santa Fe Springs
Standard Oil Co.-----	31	2	11	Santa	
Standard Oil Co.-----	31	2	11	Gertrudes 4	Santa Fe Springs

OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont'd.:					
Standard Oil Co.-----	1	2	12	Weisel 1	Santa Fe Springs
Standard Oil Co.-----	31	2	11	Jordan 1	Santa Fe Springs
Standard Oil Co.-----	31	2	11	Hepler 3	Santa Fe Springs
Union Oil Co.-----	5	3	11	Meyer 9	Santa Fe Springs
Union Oil Co.-----	31	2	11	Howard 6	Santa Fe Springs
Union Oil Co.-----	5	3	11	Meyer 13	Santa Fe Springs
Union Oil Co.-----	5	3	11	Farwell 7	Santa Fe Springs
Union Oil Co.-----	5	3	11	Meyer 10	Santa Fe Springs
C. C. M. O. Co.-----	9	4	14	Del Amo 5	Torrance
C. C. M. O. Co.-----	8	4	14	Del Amo 6	Torrance
C. C. M. O. Co.-----	10	4	14	Torrance 6	Torrance
C. C. M. O. Co.-----	16	4	14	Torrance 7	Torrance
A. F. Gilmore Co.-----	10	4	14	Leake 1	Torrance
Graham et al.-----	16	4	14	Graham 1	Torrance
Hub Oil Co.-----	15	4	14	Guss-Frye 1	Torrance
Petroleum Midway Co. Ltd.-----	9	4	14	Casad 1	Torrance
Shell Co.-----	9	4	14	Frenger 1	Torrance
Mohawk Oil and Gas Syn.-----	7	2	14	1	-----
Santa Monica Royalties Oil Well Co.	28	1	19	1	-----
R. C. Shiflet.-----	31	3	12	1	-----
ORANGE COUNTY—					
Chicksan Oil Co.-----	35	5	11	1	Huntington Beh.
George F. Getty-----	35	5	11	Andrews 2	Huntington Beh.
Holly Oil Co.-----	35	5	11	6	Huntington Beh.
Holly Oil Co.-----	35	5	11	5	Huntington Beh.
Miley-Keck Oil Co.-----	2	6	11	37	Huntington Beh.
Standard Oil Co.-----	2	6	11	Hunt. B. 20	Huntington Beh.
Texas Holding Co.-----	2	6	11	3	Huntington Beh.
Western Seaboard Oil Co.-----	35	5	11	Russell 1	Huntington Beh.
RIVERSIDE COUNTY—					
Spindle Top Oil Assn.-----	25	7	10	1	-----
SAN DIEGO COUNTY—					
R. M. Cole Oil & Gas Syn.-----	11	15	1	1	-----
SANTA BARBARA COUNTY—					
Wm. F. Tobin-----	Lo	okout	Park	4	Summerland
Wm. F. Tobin-----	Lo	okout	Park	5	Summerland
Wm. F. Tobin-----	Lo	okout	Park	6	Summerland
Wm. F. Tobin-----	Lo	okout	Park	7	Summerland
SONOMA COUNTY—					
Edgar T. Wallace-----	Ducker Ranch	5	6	1	-----
TULARE COUNTY—					
The Porterville Oil & Gas Co.-----	10	22	26	1	-----
Deisy Wilson-----	32	17	23	1	-----
VENTURA COUNTY—					
Dr. J. Von Gal-Scale-----	4	1	20	8	Conejo
Dr. J. Von Gal-Scale-----	4	1	20	9	Conejo
Dr. J. Von Gal-Scale-----	4	1	20	10	Conejo
Dr. J. Von Gal-Scale-----	4	1	20	11	Conejo
Dr. J. Von Gal-Scale-----	4	1	20	12	Conejo
Reaves Alymore, Jr.-----	20	4	19	1	Sespe

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff containing much information that will add to the permanent value of the Monthly Chapter are included in each number of 'Mining in California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

NOTES ON PEAT AND ITS OCCURRENCE IN CALIFORNIA

By C. MCK. LAIZURE.

In 1921, the last year for which figures are available, California led all other states in the Union in the production of peat. Up to the present time the peat produced here has not been utilized as a fuel, and the State Mining Bureau has never made a field investigation or survey of the state's peat resources, nor collected production statistics as it has in the case of petroleum, coal, and natural gas. The occurrence of peat in Orange and Humboldt counties was briefly noted, however, in the Tenth and Eleventh Reports of the State Mineralogist, 1890-1892.

Inquiries from various sources have come to the State Mining Bureau during the past few years regarding the possibilities of the peat industry, and for the purpose of supplying some facts regarding this little known product and the localities in which it is found, the following notes have been compiled.

No claim to originality is made, most of the data herein having previously appeared in various publications, particularly the Journal of the American Peat Society; Transactions of the Commonwealth Club of San Francisco, 1912, and the United States Geological Survey Bulletin No. 728, 1922.

Peat is defined as the organic residuum resulting from the arrested decomposition of leaves, twigs, roots, trunks of trees, shrubs, mosses, and other vegetation in areas continually covered or saturated with water.

It may be identified as the dark-colored soil found in bogs and swamps, commonly called muck, but if the material will ignite and burn freely when dry, it preferably should be termed peat.

Native peat contains about ten per cent of solid matter and ninety per cent of water. Its specific gravity ranges from 0.1 to 1.06 and it weighs from 7 to 65 pounds per cubic foot. The reduction of its high content of moisture is the paramount necessity for commercial utilization. Attempts have been made to remove the excess moisture by com-

pression, but it resists the heaviest pressure and its water content can be economically reduced only by evaporation.

The texture of peat depends upon the kinds of plants from which it was formed and the physical conditions under which it accumulated. It has been classified by its physical characteristics as turfy peat, fibrous peat, earthy peat, and pitchy peat.

Peat ranges in color from light yellow through various shades of brown to jet black, the color representing in a measure the degree of decomposition.

Chemically peat consists of carbon, hydrogen and oxygen and relatively small quantities of nitrogen. Its composition is illustrated by the following analysis (ash and moisture omitted) :

Carbon -----	59.50
Hydrogen -----	5.50
Oxygen -----	33.00
Nitrogen -----	2.00
	<hr/>
	100.00

The quantity of 'fixed' or 'free' carbon generally ranges from 10 to 60 per cent, the remainder being combined with other elements. Volatile matter usually ranges from 25 to 70 per cent, and moisture from 15 to 30 per cent in air-dried peat. As the volume of oxygen is relatively high, good peat ignites readily and burns freely, leaving little unconsumed residue. Sulphur usually ranges from 0.2 to 0.6 per cent, and nitrogen from 1 to 4 per cent. The ash in native peat, which renders it more or less impure, constitutes from 3 to 30 per cent of its dry weight. The ash content of the best peats in the United States ranges from 6 to 12 per cent, though many of the largest deposits in the Great Lakes area contain 15 per cent of ash.

The value of peat in soil fertilization lies in its content of nitrogen and humus and in the beneficial mechanical effect it produces on certain lands. Black, well-decomposed peats are the most satisfactory ordinary fertilizers, for they are generally heavier and more compact and contain more nitrogen and less fibrous material than the brown peats.

More than 50,000,000 tons of peat fuel are consumed annually by European countries, but only small quantities of peat fuel have been produced in the United States. Operators say that air-dried machine peat can be produced in the United States for from \$1.50 to \$5.00 per ton and that it could perhaps in some localities successfully compete with other fuels for domestic and industrial purposes.

Many extravagant claims concerning the fuel value of peat have been made, but authorities have concluded that peat can be converted into fuel on a large scale in the United States only in the form of machine blocks, powder, and gas.

Machine peat which is allowed to dry slowly contracts into a dense mass covered by a gelatinous skin-like substance called hydrocellulose. After the moisture has been reduced to about 25 per cent this coating renders the machine peat impervious to water, even when immersed. It is clean to handle and burns freely, yielding an intense heat and producing no soot or other objectionable deposit. For open grates this fuel is nearly ideal, and it is said that it may be burned in the same stoves as wood or coal.

For certain commercial uses powdered peat has many advantages over machine peat. In this form it may be blown with compressed air into the furnace where by means of forced draft, ignition is almost instantaneous and instead of burning on the grate the peat forms a gas which gives a uniform fire throughout the combustion chamber. Good peat thus treated when burned in furnaces designed to give the most complete and efficient combustion, will generate nearly as much energy in the form of live steam as the same weight of powdered coal. According to reports in this country, powdered peat has great possibilities, not only for boiler firing but for metallurgical work and for use in cement and other kinds of kilns in which powdered coal has been successfully burned.

Peat can also be made into briquets with a suitable binder, and although there are some advantages in the matter of cleanliness and less bulk, these advantages are largely offset by the high cost of production.

Peat coke is manufactured in Europe, and it is said to be equal in quality to the best grades of wood charcoal.

Alcohol, acetic acid, ammonia, ammonium sulphate, paraffin wax, illuminating and lubricating oil, phenol and asphalt are some of the valuable by-products obtained in coking peat by the dry distillation process.

Probably the most economical way to utilize peat as fuel is in the gas producer. Tests with Florida peat, carried on by the United States Geological Survey relative to using the producer gas for generating power, or peat under boilers for generating electricity by steam, showed that 5.78 pounds of dry peat per electrical horsepower hour were required by the steam plant, compared to 2.39 pounds with the gas producer.

Tesla coal, when used in the producer plant, required 2.38 pounds of dry coal, showing that Florida peat and Tesla coal are equivalent in this respect. It may be remarked here that the climatic conditions under which peat is formed in California are somewhat similar to those in Florida.

In comparing the gas obtained from peat with that from coal as to the heat units per cubic foot, the following results were obtained:

	B.T.U. per cubic foot
Massachusetts peat.....	166
Florida peat.....	175
Kentucky coal (average).....	164
Illinois coal.....	143
Tesla (Cal.) coal.....	158

These figures show that peat gas has a higher heating value per cubic foot than that from the better gas-making coals. It should make an excellent fuel for ceramic kilns, lime and cement kilns, metallurgical furnaces, forges, ore-roasting and similar furnaces.

A complete description of peat-fuel machinery and manufacturing processes will be found in United States Bureau of Mines Bulletin No. 16, 'Uses of Peat,' 1911.

There are many uses for peat other than for fuel purposes. Peat moss, marsh grass and fibrous peat are employed in the manufacture of surgical dressings, of rugs and carpets, of packing material, of artificial wood, of paper, and of substitutes for cotton and woolen cloth.

From October, 1917, to November 11, 1918, the Northwestern and Atlantic divisions of the American Red Cross prepared 595,540 peat-moss pads for surgical use. Most of the moss was gathered from bogs in Washington, Oregon, and Maine, and the pads were used in military hospitals at home and abroad.

Peat has lightness, resiliency and antiseptic properties and makes excellent packing material for eggs, fruit, vegetables, and fragile articles. Peat moss is utilized in shipping flowers, shrubs and plants. Dry peat is a non-conductor of heat and is valuable in ice houses and as a packing for water pipes.

In the United States peat at present is utilized chiefly as an ingredient of fertilizers and stock food and as a crop soil.

The United States contains about 12,000 square miles of undrained land estimated to be capable of yielding nearly fourteen billion short tons of air-dried peat. The average deposit will yield two hundred tons per acre-foot. The peat areas are distributed throughout the Great Lakes, New England, and Atlantic and Pacific Coast states. Minnesota, Wisconsin, Florida, and Michigan contain the most extensive deposits. The peat deposits of Canada cover 37,000 square miles.

The area of peat deposits on the Pacific Coast is small compared to that in the Northern and Atlantic coastal region, and this fact adds interest to the statement made at the beginning of this article, that in 1921 California was the largest producer of peat in the United States.

In that year the peat industry throughout the country suffered by reason of the decrease in the selling price of agricultural products, which, combined with high freight rates prevented farmers from purchasing fertilizer. The following table shows the production in the United States from 1916 to 1921:

Year	Number of plants reporting	Short tons	Value	Average price
1916 -----	13	52,506	\$369,104	\$7 03
1917 -----	18	97,363	709,900	7 29
1918 -----	25	107,261	1,047,243	9 76
1919 -----	15	69,197	705,532	10 20
1920 -----	18	73,204	921,732	12 59
1921 -----	21	30,406	260,119	8 55

The twenty-one plants reporting production in 1921 were distributed as follows: New Jersey 4, New York 4, California 3, Illinois 2, and Florida, Georgia, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, and Wisconsin 1 each. California was the largest producer, with an output of 12,672 short tons, valued at \$117,580. New Jersey ranked second, with an output of 12,051 tons, valued at \$94,269. Illinois ranked third,

The three California producers noted above all operated in southern California, but it is understood that another operator has since begun producing from the Sacramento-San Joaquin delta area. In October 1922 it was said that three cars per week were being shipped by this operator.

The thickest deposits in this state are believed to underlie the area following a line traced around the edges of the marshes and extending from Carquinez Straits to Stockton to Rio Vista, closing at the point of commencement again and covering an area in all of approximately twelve townships, 432 square miles, or 276,460 acres with peat to a thickness of from 6 to 80 feet, or an average of 43 feet. A large portion of this expanse, particularly in the eastern part, has been covered by debris from our early hydraulic mines, while in other portions the peat is more or less sandy. This acreage noted is therefore divided by two, giving as a result 138,248 acres. Of this area 60,000 acres are known to contain good peat to a depth of at least six feet or more. In one acre of land two hundred tons of machine-dried peat are recoverable for each foot of raw material. The 60,000 acres will therefore contain $60,000 \times 6 \times 200$ or 72,000,000 tons which will be placed as proved. The 138,248 acres with 43 feet of peat would contain $138,248 \times 43 \times 200$, or 1,188,932,800 tons. The amount of peat in this area under consideration is given as follows:*

Proved -----	72,000,000 tons
Possible -----	1,188,932,800 tons

No attempt has been made at any accurate estimate in the preceding figures, as such would be impossible from any existing data. It is highly probable that a large portion of the 'possible' area will be found unavailable because of mixture with silt. It is also unfortunate for the peat industry that this land is among the most valuable in California for agricultural purposes and it is questionable if peat products will prove more remunerative than those of agriculture.

Shallower peat beds are also known to exist in parts of Sutter and Yolo basins, throughout the marshes of San Francisco Bay, in the marshes near the mouth of the Salinas River and in that portion of Klamath Lake located in California. Peat also occurs in Humboldt, Siskiyou, Los Angeles, Orange, and San Bernardino counties, but these localities do not begin to compare in possibilities with those of the lower Sacramento and San Joaquin River area.

The peat industry already developed in California, despite an almost total lack of definite data regarding occurrences of this interesting raw material, would indicate that it is a product whose possibilities are far from being fully realized and one well worthy of further study.

*Requa, M. L., Bradley, F. W., and Stalder W., Fuel Resources of California; Commonwealth Club of San Francisco, Trans. 1912.

SECRETARY'S OFFICE.

WALTER W. BRADLEY, Deputy State Mineralogist.

The California State Mining Bureau was created April 16, 1880, by legislative act. In March, 1893, the original act was repealed and an amended act approved and passed by the legislative body. Again on June 16, 1913, a new Mining Bureau Act was approved which became effective August 10, 1913, repealing all former acts, and forming the basic law under which the Bureau now functions.

It is doubtless true that both the mining and lay public have not in the past always recognized the part played by the Bureau in the development of the state's mineral resources. Innumerable inquiries regarding them, originating within and without its borders and in foreign countries, have been answered with ultimate results reflected by a consistent growth in the value of the state's mineral output since the records of production were first compiled by the Bureau in 1887.

This organization has been occupied for 43 years in actively and in all possible ways assisting in the development of California's mineral resources. Its work, whenever possible, is made a matter of permanent record by means of published bulletins and reports. These publications form a cumulative, live and up-to-date history of mining progress in the state. Prospective investors from other states and other lands come to the State Mining Bureau for information as to the location of mineral deposits, the extent and value of their mineral content, and names of owners with whom they may enter into business transactions. Owners and operators—producers of raw materials—come to the Bureau to find out where they may be able to market their output, and to learn whether or not the mineral they have discovered is commercially valuable, and if it meets the requirements of the consumer.

It is believed that a fuller understanding of the economic position occupied by the Bureau can be imparted to the public, whose funds support it, by embodying in these chapters a review of the executive activities. The responsibility for the coordination of effort of each department, to the end that the utmost efficiency may be maintained with the limited and variable appropriations accorded the Bureau by successive legislatures, rests upon the administrative office.

Activities referable to that office, such as reports of new maps and publications issued, amount of mail handled, changes and enlargements in offices, changes in personnel of the staff, property and equipment, financial statements, etc., are therefore included herein.

New Publications.

During the month the following Bureau publications have been made available for distribution:

Summary of Operations, California Oil Fields, November, 1922, Vol. 8, No. 5.
Mining in California, November, 1922, Vol. 18, No. 11.

Distribution of Publications.

The Bureau's publications are constantly in demand, requests for copies coming from all over the United States and foreign countries. Publications were distributed during the month as follows:

Publications	Number Distributed
Report XI, State Mineralogist.....	2
Report XIV, State Mineralogist.....	7
Report XV, State Mineralogist.....	3
Report XVII, State Mineralogist.....	3
Mines and Mineral Resources of Colusa, etc.....	2
Mines and Mineral Resources of Del Norte, etc.....	3
Mines and Mineral Resources of Fresno, etc.....	1
Mines and Mineral Resources of Imperial, etc.....	5
Mines and Mineral Resources of Alpine, etc.....	5
Mines and Mineral Resources of El Dorado, etc.....	6
Mines and Mineral Resources of Los Angeles, etc.....	3
Mines and Mineral Resources of Monterey, etc.....	4
Mines and Mineral Resources of San Bernardino, etc.....	6
Mines and Mineral Resources of Nevada County.....	3
Mines and Mineral Resources of Plumas County.....	2
Mines and Mineral Resources of Sierra County.....	3
Bulletin No. 6, California Gold Mill Practices.....	3
Bulletin No. 37, Gems, Jewelers Materials, Ornamental Stones of California.....	11
Bulletin No. 50, Copper Resources of California (Revised).....	2
Bulletin No. 72, Geologic Formations of California.....	17
Bulletin No. 75, U. S. and California Mining Laws.....	20
Bulletin No. 76, Manganese and Chromium in California.....	3
Bulletin No. 78, Quicksilver Resources of California.....	5
Bulletin No. 85, Platinum Resources of California.....	8
Bulletin No. 89, Petroleum Resources of California with special reference to unproved areas.....	93
Bulletin No. 90, California Mineral Production for 1920, with County Maps.....	15
Mining in California (Monthly), Vol. 18, No. 11, November.....	3200
Mining in California (Monthly), Vol. 18, No. 10, October.....	10
Summary of Operations, California Oil Fields (Monthly), Vol. 8, No. 4, October, 1922.....	3000
County Maps and Registers of Mines.....	4
Copper Deposit Map.....	2
Inyo County Geological Map.....	3
Minaret Map.....	1
Tuolumne County Mineral Map.....	1
Geological Map of California, mounted.....	14
Lake County Map.....	1
Oil Field Maps.....	262
Map accompanying Bulletin 89.....	49

Mails and Files.

The Bureau maintains in addition to its correspondence file a mine report file which includes reports on some 7500 mines and mineral properties in California. Also there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the month 774 letters were received and answered. They are practically all requests for information and the inquiries cover all phases of prospecting, mining and developing mineral deposits, reduction of crude minerals and marketing of refined products.

Drafting Room.

This is purely a workshop, and is the only branch of the Bureau that is not primarily at the service of the public. In the drafting room

well logs, maps, sketches, etc., are prepared for the many publications and reports which are under way at all times.

Changes in Personnel.

Announcement is authorized of the resignation of Mr. W. W. Thayer, as secretary, who leaves the State Mining Bureau after a service of seventeen years in the department.

Mr. Walter W. Bradley, for several years past statistician and curator of the State Mining Bureau, has been promoted to the position of deputy state mineralogist, which position will combine the duties formerly exercised by the 'chief mining engineer' and the 'secretary.' With additional clerical assistance, Mr. Bradley will also supervise the work of the statistical division.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

California produces commercially at least fifty different mineral substances, with a total annual value averaging in recent years in excess of \$250,000,000. There are several thousand operating properties, including mines, quarries, oil and gas wells, mineral springs, gravel pits, mills and smelters. The task of compiling accurate and dependable statistics covering these activities is a difficult one, requiring care and a technical knowledge of properties and processes.

Blank report forms for the 1922 data were mailed to the operators, in January, 1923, followed by a 'second request' early in March. At present writing (March 15), the majority of the reports are in hand. Data for several substances are now complete and have been compiled, being presented herewith.

The data at hand indicate that there was no production in California of the following substances, which have at one time or another in the past been on the active list here: Antimony, bismuth, cadmium, mica, molybdenum, nickel, nitrates, serpentine, sulphur, strontium, tin, tungsten, vanadium.

ALUMINUM.

Bibliography: Bulletins 38, 67. U. S. G. S., Min. Res. of U. S.

To date there has been no commercial production of aluminum ore in California. The first authentic find of bauxite in this state was noted in the April, 1922, issue of 'Mining in California' (see Report XVIII, page 198; also 'Pacific Mining News,' p. 13, May, 1922). It is in Riverside County, southeast of Corona, but as yet undeveloped.

Minerals containing aluminum are abundant, the most widely distributed being the clays. There are only two, however, thus far of consequence, commercially, in the production of the metal: bauxite (to which may be added the related, hydrated oxides, hydrargillite and diaspore), and cryolite. Cryolite is found in commercial quantities only in South Greenland, and was formerly the only ore of aluminum used, being still employed as a flux in the extraction of the metal. Bauxite has been, for some years, the most important source of aluminum and its salts. Its color varies from gray to red, according to the amount of iron present, the composition ranging usually between the following limits: Al_2O_3 , 30%-60%; Fe_2O_3 , 3%-25%; SiO_2 , 0.5%-20%; TiO_2 , 0.0%-10%. Besides its reduction to the metal, bauxite is also utilized in the manufacture of: aluminum salts, refractory bricks, aluminum (fused alumina) for use as an abrasive; and in the refining of oil (stated to be of growing importance). The most important producing countries, both of bauxite and the metal, are the United States and France, the former yielding more than 60 per cent of the world's output. In 1913 France led.

Because of its light weight (2.58 specific gravity), the metal, aluminum, has many important industrial uses, particularly in the manufacture of aeroplanes, airships, automobiles, cooking utensils, and electrical

apparatus. The use of aluminum dust in place of zinc dust for precipitating precious metal from cyanide solutions is increasing. In the Thermit process of welding and casting, aluminum in fine grains or filings is mixed with the oxide (usually iron oxide) to be reduced.

Present quotations for aluminum are 23¢-24¢ per pound, according to grade, for the refined metal.

ANTIMONY.

Bibliography: State Mineralogist Reports VIII, X, XII, XIII, XIV, XV, XVII. Bulletin 38.

Production of antimony in California has been irregular, and small in amount except during the year 1916 when the high war-time prices permitted American producers, for a short period, to compete with Chinese antimony. The principal commercial production of antimony in California has come from Kern, Inyo, and San Benito counties, and other occurrences have been noted in Nevada, Riverside, and Santa Clara counties. The commonest occurrence is in the form of the sulphide, stibnite; but in the Kernville, and Hayilah districts in Kern County there were notable deposits of the native metal, being among the few localities of the world where native antimony has been found.

California producers claim that they can not operate profitably unless the price of antimony be above 12 cents per pound. Present New York quotations are around 8 cents per pound.

Pure antimony metal, and manufactured antimony compounds are of considerable importance as pigments in the ceramic industry. The most important use of the metal, commercially, is in various alloys, particularly type-metal (with tin and lead), babbitt (with tin and copper), and britannia metal (with tin and copper).

The production of antimony in California by years since 1887 has been as follows:

Year	Tons	Value	Year	Tons	Value
1887 -----	75	\$15,500	1900 -----	70	\$5,700
1888 -----	100	20,000	1901 -----	50	8,350
1889 -----			1902 -----		
1893 -----	50	2,250	1915 -----	510	35,666
1894 -----	150	6,000	1916 -----	1,015	64,793
1895 -----	33	1,485	1917 -----	158	18,786
1896 -----	17	2,320	1918 -----		
1897 -----	20	3,500			
1898 -----	40	1,200			
1899 -----	75	13,500	Totals -----	2,363	\$199,050

ARSENIC.

Bibliography: Bulletin 67. U. S. G. S., Min. Res. of U. S.

Arsenic is found in a number of localities in California in the mineral arsenopyrite (FeAsS), which is frequently gold bearing; and in scorodite ($\text{FeAsO}_4 + 2\text{H}_2\text{O}$), an oxidation product of arsenopyrite. The occurrence of realgar (AsS) has also been noted (see Report XVIII page 197). To date, there has been no commercial output of arsenic from California ores. The principal source of the arsenic of commerce

in the United States has been as a by-product from the metallurgical treatment of copper, gold, and lead ores. It is usually recovered in the form of the tri-oxide, or 'white arsenic,' for which there is a demand for the preparation of insecticides, for use in agriculture and horticulture, and especially against the cotton-boll weevil in the southern states.

BARYTES.

Bibliography: State Mineralogist Reports XII, XIV, XV, XVII. Bulletin 38. Eng. & Min. Jour.-Press, Vol. 114, p. 109, July 15, 1922; Vol. 115, pp. 319-324, Feb. 17, 1923.

The output of crude barytes in California during 1922 was 3,370 tons valued at \$18,925, as compared with 1921 production of 901 tons, worth \$4,809. This included, in part, witherite (BaCO_3) from the deposit at El Portal, Mariposa County, which yields both the sulphate and carbonate. Most of the output of barytes in California, at present, is being utilized in the manufacture of lithopone.

The principal uses for barytes after washing and grinding, are as an inert pigment and filler in paint, paper, linoleum, oilcloth and rubber manufacture, and in the preparation of lithopone and a number of chemicals. The most important of such chemicals, other than lithopone, are: barium binoxide (used in preparation of hydrogen peroxide); barium carbonate (used by pressed brick and by rubber manufacturers to neutralize sulphur content); barium chloride (used in battery plates, and as a mordant by dry-color manufacturers, and in tanning leather); barium nitrate (used in munitions and in making 'red fire' material); barium sulphate precipitated, or 'blanc fixe' (used in rubber manufacture; for painting on interior steel of battle-ships and other sea-going vessels; also as a detector in taking X-ray pictures of the human body).

More than half of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone. This is a chemically-prepared, white pigment containing about 70% barium sulphate and 30% zinc sulphide, and is one of the principal constituents of 'flat' wall paints now so extensively used in office buildings and hospitals, replacing both paper and calcimine wall finishes. Present quotations for barytes vary from \$5 to \$9 per ton, crude, f. o. b. rail-shipping point, depending on quality. Most barite has to be washed and acid-treated to remove iron stains or other impurities before being suitable for paint use.

Known occurrences of this mineral in California are located in Inyo, Los Angeles, Mariposa, Monterey, Nevada, San Bernardino, Shasta and Santa Barbara counties. The deposit at El Portal, in Mariposa County, has given the largest commercial production to date, in part witherite (barium carbonate, BaCO_3). The 1915 output was the first commercial production of the carbonate in the United States of which we have record. In 1916-1920, some tonnage of barytes came from a deposit opened up on Fremont's Peak, Monterey County, near the line of San Benito County; in 1919-1922, shipments were made from Nevada County. Shasta County is in the list for 1921-1922.

The first recorded production of barytes in California, according to the statistical reports of the State Mining Bureau, was in 1910. The annual figures are as follows:

Year	Tons	Value	Year	Tons	Value
1910 -----	860	\$5,640	1918 -----	100	\$1,500
1911 -----	309	2,207	1919 -----	1,501	18,065
1912 -----	564	2,812	1920 -----	3,029	20,795
1913 -----	1,600	3,680	1921 -----	901	4,809
1914 -----	2,000	3,000	1922 -----	3,370	18,925
1915 -----	410	620	Totals -----	20,670	\$113,202
1916 -----	1,606	5,516			
1917 -----	4,420	25,633			

BISMUTH.

Bibliography: Bulletins 38, 67. Am. Jour. Sci. 1903, Vol. 16.

Several bismuth minerals have been found in California, notably native bismuth and bismite (the ochre) in the tourmaline gem district in San Diego and Riverside counties near Pala. Other occurrences of bismuth minerals, including the sulphide, bismuthinite, have been noted in Inyo, Fresno, Nevada, Tuolumne, and Mono counties, but only in small quantities. The only commercial production recorded was 20 tons valued at \$2,400, in 1904, and credited to Riverside County.

In 1917, a few pounds of bismuthinite (Bi_2S_3) with associated bismutite ($\text{Bi}_2\text{CO}_3 \cdot \text{H}_2\text{O}$), was taken out at the United Tungsten Copper mine, in the Morongo district, San Bernardino County. It is associated with scheelite in a contact deposit between limestone and granite.

Recovery of bismuth from blister copper in the electrolytic refinery has been noted,¹ ranging as high as 27.3 pounds of metallic bismuth per 100 tons of blister copper from the Iron Mountain, Shasta County, ores. In the United States, the principal recovery of bismuth is obtained as a by-product from the refining of lead bullion.

The uses of bismuth are somewhat restricted, being employed principally in the preparation of medicinal salts, and in low melting-point or cliché alloys. These alloys are utilized in automatic fire sprinkler systems, in electrical fuses, and in solders.

Present quotations for bismuth are \$2.55 per pound for the refined metal.

CADMIUM.

Bibliography: U. S. G. S., Min. Res. of U. S., 1908, 1918.

During 1917 and 1918, cadmium metal was recovered by the electrolytic zinc plant of the Mammoth Copper Company in Shasta County. It was shipped in the form of 'sticks' and amounted to a total of several thousand pounds for the two years, the exact figures being concealed under 'Unapportioned.' That was the first, and thus far the only, commercial production of cadmium recorded from California ore. Cadmium there occurs associated with zinc sulphide, sphalerite, probably as the sulphide, greenockite. Cadmium also occurs in the Cerro Gordo Mine, Inyo County, associated with smithsonite (zinc carbonate).

There are several cadmium minerals, but none of them occur in sufficient quantities individually to be profitable as distinct ores. The cadmium of commerce is derived as a by-product in the reduction of

¹Trans. Am. Inst. Min. Eng., Vol. 47, pp. 217-218.

zinc minerals and ores, in nearly all of which it occurs in at least minute proportions, the average ratio being about 1 of cadmium to 200 of zinc. As cadmium behaves metallurgically much the same as zinc, it constitutes a fraction of 1 per cent of nearly all metallic zinc.

Cadmium is produced in United States in two forms—metallic cadmium and the pigment, cadmium sulphide. The principal use of the metal is in low-melting point, or cliché alloys, and its salts are utilized in the arts, medicine, and in electroplating. The sulphide is employed as a paint pigment, being a strong yellow, which is unaffected by hydrogen sulphide gas from coal smoke. It is also employed in coloring glass and porcelain. Cadmium cliché metal is stated to be superior to the corresponding bismuth alloy, for making stereotype plates. Cadmium is also used in bronze telegraph and telephone wires, and gives some promise of being utilized in electroplating.

Present quotations for cadmium are \$1.15 per pound for the refined metal.

COBALT.

Bibliography: Report XIV; Bulletin 67. U. S. G. S., Min. Res. of U. S., 1912, 1918.

Occurrences of some of the cobalt minerals have been noted in several localities in California, but to date no commercial deposits have been developed. Some of the copper ores of the foothill copper belt in Mariposa and Madera counties have been found to contain cobalt up to 3%.

The most important use of cobalt is in the manufacture of the alloy, stellite, in which it is combined with chromium, for making high-speed lathe tools, and non-tarnishing cutlery and surgeons' appliances. The metal is also used in electroplating, similarly to nickel; and the oxide, carbonate, chloride, sulphate and other salts are used in ceramics for coloring. Some of the organic salts of cobalt (acetate, resinate, oleate) are employed as 'driers' in paint and varnish.

Present quotations for cobalt are \$2.65–\$2.85 per pound for the refined metal.

GRAPHITE.

Bibliography: State Mineralogist Reports XIII, XIV, XV, XVII. Bulletin 67. U. S. G. S., Min. Res., 1914, Pt. II.

Graphite has been produced from time to time in the State, coming principally from Sonoma and Los Angeles counties. It is difficult for these deposits, which must be concentrated, to compete with foreign supplies, which go on the market almost directly as they come from the deposit. Graphite ores are concentrated with considerable difficulty, and the electric process of manufacturing artificial graphite from coal has been perfected to such a degree that only deposits of natural graphite of a superior quality can be exploited with any certainty of success.

According to the U. S. Geological Survey, operators in this country who are working disseminated flake deposits must depend on their No. 1 and 2 flake for their profit. Graphite dust is merely a by-product and is salable only at a low price. Improved methods of graphite milling adopted promise to increase largely the production of flake of better grade.

The principal value of graphite is on account of its infusibility and resistance to the action of molten metals. It is also largely used in the manufacture of electrical appliances, of 'lead' pencils, as a lubricant, as stove polish, paints, and in many other ways. Amorphous graphite, commonly carrying many impurities, brings a much lower price. For some purposes, such as foundry facings, etc., the low-grade material is satisfactory. Among the newer uses for graphite is the prevention of formation of scale in boilers. The action is a mechanical one. Being soft and slippery, the graphite prevents the particles of scale from adhering to one another or to the boiler and they are thus easily removed.

The price increases with the grade of material, the best quality crystalline variety being quoted at present at 6¢-6½¢ per pound (Ceylon lumps); with American flake at 4¢-5¢ per pound f.o.b. mine.

The coarser flakes are necessary for crucibles, as they help to bind the clay together in addition to their refractory service. Since the close of hostilities in Europe, prices have declined to pre-war levels; and imports have been resumed from Ceylon, Canada, Madagascar, Mexico and Korea, of a total of 7496 tons valued at \$452,076 in 1921.

Occurrence of graphite has been reported at various times from Calaveras, Fresno, Imperial, Los Angeles, Mendocino, San Bernardino, San Diego, Siskiyou, Sonoma and Tuolumne counties.

During 1922 an increased production was reported from Los Angeles County. It was concentrated from a disseminated ore, and was used for paint and foundry facing. As there was but a single operator, the figures are concealed under the 'Unapportioned' item. The production, by years, has been as follows:

Year	Pounds	Value
1901	128,000	\$4,480
1902	84,000	1,680
1903		
1913	2,500	25
1914		
1915		
1916	29,190	2,335
1917		
1918	*770,000	37,225
1919		
1920		
1921	*624,000	26,160
1922		
Totals	1,637,690	\$71,905

*Annual details concealed under 'Unapportioned,' on account of a single producer.

INFUSORIAL AND DIATOMACEOUS EARTHS.

Bibliography: State Mineralogist Reports II, XII, XIII, XIV, XV, XVII, XVIII. Bulletins 38, 67. Am. Inst. Min. Eng., Bull. 104, August, 1915, pp. 1539-1550. U. S. Bur. of Mines, Rep. of Investigations: Serial No. 2431, Jan., 1923.

Infusorial and diatomaceous earths—sometimes called tripolite—are very light and extremely porous, chalk-like materials composed of pure silica (chalk, being calcareous) which have been laid down under water and consist of the remains of microscopical infusoria and diatoms.

The former are animal remains, and the latter are from plants. The principal commercial use of this material is as an absorbent. It is also employed in the manufacture of scouring soap and polishing powders; for filtration purposes; in making some classes of refractory brick; and as an insulating medium both in heating and refrigeration. It is a first-class nonconductor of heat, where high temperatures are employed, such as around steel and gas plants and power houses. In such cases, it is built in as an insulating layer in furnace walls. In Germany, under the name 'kieselguhr,' it was used as an absorbent for nitroglycerine in the early manufacture of dynamite.

As a nonconductor of heat it has been used alone or with other materials as a covering for boilers, steam pipes, and safes and in fireproof cements. It is used largely by paint manufacturers as a wood filler. Boiled with shellac it is made into records for talking machines. It has been used for absorbing liquid manures so that they could be utilized as fertilizers, and as a source of silica in making water-glass as well as in the manufacture of cement, tile glazing, artificial stone, ultra-marine and other pigments of aniline and alizarine colors, paper filling, sealing wax, fireworks, hard-rubber objects, matches, and papier maché, and for solidifying bromine. For making insulating brick the material is sawed into blocks, and for all other purposes it is ground and screened.

The most important deposits in California thus far known are located in Monterey, Orange, San Luis Obispo, and Santa Barbara counties. The Santa Barbara material is diatomaceous and is of a superior quality. Infusorial earth is also found in Fresno, Kern, Los Angeles, Plumas, San Benito, San Bernardino, San Joaquin, Shasta, Sonoma, and Tehama counties.

The following description of the deposit and plant of the Celite Products Company at Lompoc, Santa Barbara County, is quoted from a recent paper published by the U. S. Bureau of mines:¹

"The character of the material varies in different parts of the bed and only selected parts where the overburden is light, are quarried. Also, certain parts of the bed are used for specific purposes. After cleaning off the overburden, the diatomaceous earth is quarried by means of a channeling machine developed by the company. Cuts are made across the face 4 feet deep and 4 feet apart. The largest part of the production is used for insulating brick, which are sawed on the ground from the blocks cut by the channeling machines. The machine used for sawing the brick was also developed by the company. The material desired for grinding is quarried, after channeling, by pick and shovel and loaded by hand into horse-drawn wagons and then hauled to a drying yard. The brick are hauled to a drying yard in light tram cars. After sun-drying, the brick are hauled to the railroad, and the other product to the mill in motor trucks.

"At the mill, the sun-dried diatomaceous earth is fed by hand into an impact pulverizer, which is moved along the bottom of the storage bin. The pulverized material is drawn through galvanized iron tubing by an exhaust fan to the main building where it is packed for shipment in bags. The unbroken single diatoms are desired for filtering and some other uses. The dust, consisting of the finer particles and broken diatoms, which does not settle in the bins of the main building, is drawn into a bag house where it is filtered out of the air. This material is used for polishes and other similar purposes. All crushing is done dry.

"The Kieselguhr is nearly pure silica and has the capacity of absorbing several times its weight of liquids. Dr. Herbert Insley, petrologist, U. S. Bureau of Mines, examined some of the samples under the microscope and made the following report:

"This material is very light in weight due in part to its great porosity. Under the microscope, the material was found to be made up almost wholly of the tests or skeletons of diatoms. These tests are composed of practically pure silica. The silica is evidently amorphous for there is no evidence of double refraction between crossed nicols. Most of the skeletons were unbroken. Complete skeletons more than three-tenths of a millimeter in greatest dimension were not observed, although some of the skeletons of which fragments were observed must have been at least seven-tenths of a millimeter in length. Disk-like diatoms containing hexagonal perforations or depressions and long, slender spine-like diatoms are very common."

"Photomicrographs made by Dr. Insley show considerable fine dust and many sharp-edged particles.

"The deposit is damp when first exposed, but during the summer months, the air is very dry and the wind blows almost continuously, hence the surface is soon dried. Since the kieselguhr is very light, the dust is easily picked up by the wind."

¹Gardner, E. D., Mining diatomaceous earth at Lompoc, California: U. S. B. of M., Reports of Investigations Serial No. 2431, Jan. 1923.

As over 95 per cent of the output in California is from a single operator, we have concealed the exact figures under the 'Unapportioned' item in the state and county totals. There were three operators in 1922 in San Luis Obispo and Santa Barbara counties.

Total Production of Diatomaceous Earth in California.

The first recorded production of these materials in California occurred in 1889; total amount and value of output, to date, are as follows:

Year	Tons	Value	Year	Tons	Value
1889 -----	39	\$1,335	1907 -----	2,531	\$28,948
1890 -----			1908 -----	2,950	32,012
1891 -----			1909 -----	500	3,500
1892 -----			1910 -----	1,843	17,617
1893 -----	50	2,000	1911 -----	2,194	19,670
1894 -----	51	2,040	1912 -----	4,129	17,074
1895 -----			1913 -----	8,645	35,968
1896 -----			1914 -----	12,840	80,350
1897 -----	5	200	1915 -----	12,400	62,000
1898 -----			1916 -----	15,322	80,649
1899 -----			1917 -----	24,301	127,510
1900 -----			1918 -----	35,963	189,459
1901 -----			1919 -----	40,200	217,800
1902 -----	422	2,532	1920 -----	60,764	1,056,260
1903 -----	2,703	16,015	1921 -----	*90,739	1,016,675
1904 -----	6,950	112,282	1922 -----		
1905 -----	3,000	15,000			
1906 -----	2,430	14,400	Totals -----	330,971	\$3,151,296

*Annual details concealed under 'unapportioned.'

LITHIA.

Bibliography: State Mineralogist Reports II, IV, XIV. Bulletins 38, 67.

Lithia mica, lepidolite (a silicate of lithium et al.) utilized in the manufacture of artificial mineral water, fireworks, glass, etc., has been mined in San Diego County since 1899, except between 1905 and 1915. Some amblygonite, a lithium phosphate, has also been obtained from pockets associated with the gem tourmalines. In 1922 there was a slight drop in the yield of lepidolite, the output being utilized in glass manufacture. As there was only a single producer, the figures are concealed under the 'unapportioned' item. The average value reported was \$15.30 per ton, f.o.b. rail-shipping point.

Lithia mica total production in the state has been as follows:

Year	Tons	Value	Year	Tons	Value
1899 -----	124	\$4,600	1916 -----	71	\$1,065
1900 -----	440	11,000	1917 -----	880	8,800
1901 -----	1,100	27,500	1918 -----	4,111	73,598
1902 -----	822	31,880	1919 -----	800	14,400
1903 -----	700	27,300	1920 -----	10,046	153,502
1904 -----	641	25,000	1921 -----	*1,365	20,781
1905 -----	25	276	1922 -----		
1906 -----					
1915 -----	91	1,365	Totals -----	21,216	\$401,467

*Annual details concealed under 'Unapportioned.'

According to the U. S. Geological Survey, the only other production of lithium minerals in the United States outside of California in recent years has been spodumene from South Dakota.

MAGNESITE.

Bibliography: State Mineralogist Reports XII, XIII, XIV, XV, XVII; Bulletin 38. U. S. G. S., Bulletins 355, 540; Min. Res. 1913, Pt. II, pp. 450-453. Min. & Sci. Press, Vol. 114, p. 237, "Magnesite"—Hearings before the Comm. on Ways and Means, House of Repr., on H. R. 5218, June 16, 17 and July 17, 1919. Eng. Soc. W. Penn., Proc. 1913, Vol. 29, pp. 305-388, 418-444. Eng. & Min. Jour.-Press, Vol. 114, July 29, and Dec. 2, 1922.

Occurrence.

Magnesite is a natural carbonate of magnesium, and when pure contains 52.4% CO_2 (carbon dioxide) and 47.6% MgO (magnesia). It has a hardness of 3.5 to 4.5, and specific gravity of 3 to 3.12. It is both harder and heavier than calcite (calcium carbonate), and also contains a higher percentage of CO_2 , as calcite has but 44%.

Most of the California magnesite is comparatively pure, and is ordinarily a beautiful, white, fine-grained rock with a conchoidal fracture resembling a break in porcelain. The Grecian magnesite is largely of this character; while the Austrian varieties usually contain iron, so that they become brown after calcining. The Washington magnesite resembles dolomite and some crystalline limestones in physical appearance. Its color varies through light to dark gray, and pink.

In California the known deposits are mostly in the metamorphic rocks of the Coast Ranges and Sierra Nevada Mountains, being associated with serpentine areas. The notable exceptions are the sedimentary deposits, at Bissell in Kern County and at Afton in San Bernardino County. Several thousand tons have been shipped from the Bissell deposit; and small shipments have been made from the Afton property.

The Washington deposits are associated with extensive strata of dolomitic limestone. The magnesite there appears to contain more iron than most of the California mineral, which makes it desirable for the steel operators. However, recent experience has proven that several California localities have sufficient iron in their magnesite to be serviceable in the steel furnaces. This is particularly true of the Refractory Magnesite Company's mine near Preston in Sonoma County, and the White Rock Mine at Pope Valley, Napa County.

Uses.

The principal uses include: Refractory linings for basic open-hearth steel furnaces, copper reverberatories and converters, bullion and other metallurgical furnaces; in the manufacture of paper from wood pulp; and in structural work, for exterior stucco, for flooring, wainscoting, tiling, sanitary kitchen and hospital finishing, etc. In connection with building work it has proven particularly efficient as a flooring for steel railroad coaches, on account of having greater elasticity and resilience than 'Portland' cement. For refractory purposes the magnesite is 'dead burned'—i. e., all or practically all of the CO_2 is expelled from it. For cement purposes it is left 'caustic'—i. e., from 2% to 10% of CO_2 is retained. When dry caustic magnesite is mixed with a solution of

magnesium chloride ($MgCl_2$) in proper proportions, a very strong cement is produced, known as oxychloride or Sorel cement. It is applied in a plastic form, which sets in a few hours as a tough, seamless surface. It has also a very strong bonding power, and will hold firmly to wood, metal, or concrete as a base. It may be finished with a very smooth, even surface, which will take a good wax or oil polish. As ordinarily mixed there is added a certain proportion of wood flour, cork, asbestos, or other filler, thereby adding to the elastic properties of the finished product. Its surface is described as 'warm' and 'quiet' as a result of the elastic and nonconducting character of the composite material. The cement is frequently colored by the addition of some mineral pigment to the materials before mixing as cement.

The desirable qualities of any flooring material (cost not considered) are listed for purposes of analysis or comparison under eighteen heads, as follows: Cleanliness (sanitary qualities), quietness, immunity from abrasion (surface wear), resilience, immunity from slipperiness, appearance, waterproof character, plasticity, warmth (thermal insulation), life (immunity from deterioration with age), acid-proof character, alkali-proof character, fire resistance, elasticity, crushing strength, structural strength (rupture), immunity from expansion and contraction, and lightness. The importance of these several qualities varies with the varying requirements to be met; for instance, in some places, as in hospitals, cleanliness is one of the prime considerations; in other places immunity from abrasion might be one of the principal requisites. As to most of these qualities the conclusion is reached that the magnesia cement affords one of the most satisfactory flooring materials for many purposes, such as in kitchen, laundry, toilet and bathrooms, corridors, large rooms or halls in public or other buildings, including hospitals, factories, shops and restaurants.

There is no doubt that the material is steadily coming into more general recognition and favor for these uses. For a few special uses it is more or less disqualified; as an instance, it is not suited for construction of swimming tanks or for conditions of permanent wetness, since under constant immersion it gradually softens, although it is said to withstand intermittent wetting and drying and is recommended for shower baths. Naturally it is not acid-proof and not wholly alkali-proof, which might be a disadvantage in use for laboratory floors and tables; but these are rather special requirements. Its cost per square foot is given (in 1913) as 25 to 33 cents, depending on area, which is estimated to be lower than marble, cork, rubber, clay or mosaic tile, slate or terrazzo, although more expensive than wood, asphalt, linoleum or Portland cement.

In the discussion of the subject (see Bibliography) the causes of failure are ascribed to uncertain climatic changes, lack of uniformity in the mixtures used, lack of care on the part of those handling the materials, possible deterioration of materials used through exposure (either before or after mixing), lack of proper preparation of foundations on which the material is to be laid, and, as a very important factor, experience or nonexperience in the manipulation or actual laying and troweling of the material. Data concerning the percentages of magnesium chloride and of ground calcined magnesia and data concerning the character and quantity of filler and color added to the commercial preparations are naturally guarded as trade secrets by the firms already in the

business. The examination and standardization of the raw materials used, and of acceptable filler materials, and the establishment of standard proportions for the mixtures would seem to be about the only satisfactory way of attacking the problem.

The condition of the calcination of magnesite for cement uses is important, as the same material may undoubtedly be greatly varied in its reacting properties by differing treatment in the kiln. It is generally agreed that the magnesite for cement use must be comparatively free from lime, as lime has a greater tendency to reabsorb water and carbon dioxide than the magnesia, thereby causing swelling, and is therefore not so permanent in the completed cement as a pure magnesia material. The fillers used may constitute 10% to 40% of the whole cement, and commonly consist of ground marble, sand, sawdust, cork, asbestos or other materials. As an example of the formulas used in mixing such cements the following are quoted:¹

Mixtures for the underlying or coarser layer.

[Parts by weight.]

1. 15 parts magnesia.
10 parts magnesium chloride solution, 20° Baumé.
10 parts moist sawdust.
(Sets in 36 hours.)
2. 10 parts magnesia.
10 parts magnesium chloride solution, 28° Baumé.
5 parts sawdust.
(Sets in 16 hours.)
3. 20 parts magnesia.
15 parts magnesium chloride solution, 20° Baumé.
4 parts ground cork.
(Sets in 24 hours.)
4. 5 parts magnesia.
3 parts magnesium chloride solution, 20° Baumé.
5 parts ashes.
(Sets in 24 hours.)

Mixtures for overlying or surface layers.

[Parts by weight.]

1. 40 parts magnesia.
33 parts magnesium chloride solution, 19° Baumé.
10 parts asbestos powder.
5 parts wood flour.
1 part red ocher.
(Sets in 24 hours.)
2. 25 parts magnesia.
25 parts magnesium chloride, 21° Baumé.
4½ parts wood flour, impregnated with 4½ parts Terpentinharzlösung.
15 parts yellow ocher.
(Sets in 30 hours.)

The magnesite used is the fine-ground calcined (not dead-burned) of certain specified kinds or place of derivation regularly sold for plastic purposes. This material commonly comes in paper-lined casks, barrels or boxes, in which form it is fairly permanent, but it deteriorates by exposure, absorbing carbonic acid and moisture from the air. If

¹Scherer, Robert—Der Magnesit, sein Vorkommen, seine Gewinnung und technische Verwertung, pp. 216-217, A. Hartleben's Bibliothek, Wien und Leipzig, 1908.

carefully handled it can probably be kept unopened a year or more, but it should be used within a few weeks after being opened, even under most favorable conditions.

The use of magnesia cement has been suggested as a protecting coating for mine timbers, particularly against the fire hazard. The necessary qualities for any substance for such purpose have been summarized as follows: It should be resistant to abrasion, and to impact and structural stresses. It should be durable when subjected to the action of the elements, and stable to any minor derangements of the base on which it is placed. It must be relatively unaffected by changes in temperature, by the action of water, and should adhere to the material on which it is placed, and it should also be free from shrinkage cracks due to setting up the material, and have the ability to resist fire. Magnesite cement appears to fulfill the various conditions thus outlined.

It is stated that some metallic magnesium has been prepared electrolytically at Niagara Falls from magnesite.

For refractory purposes the calcined magnesite is largely made up into bricks, similar to fire-brick for furnace linings. It is also used un-consolidated, as 'grain' magnesite. For such, an iron content is desirable, as it allows of a slight sintering in forming the brick. Dead-burned, pure, magnesia can not be sintered except at very high temperatures; and it has little or no plasticity, so that it is hard to handle. Its plasticity is said to be improved by using with it some partly calcined or caustic magnesite. Heavy pressure will bind the material sufficiently to allow it to be sintered.

A coating of crushed magnesite is laid on hearths used for heating steel stock for rolling, to prevent the scale formed from attacking the fire-brick of the hearth.

Imports and Domestic Production.

Reports of the U. S. Bureau of Foreign and Domestic Commerce show imports of calcined magnesite to have been 172,591 long tons in 1913; 144,747 in 1914, and 63,347 in 1915; most of it coming from Austria-Hungary and some from Greece. For the same years the production of crude (from 2 to $2\frac{1}{2}$ tons of crude ore required to yield one ton of the calcined) magnesite in California (the sole producer of those years, in the United States) was: 9632 short tons, 11,438 tons, 30,721 tons, respectively. For 1916 the California output leaped to 154,052 tons of crude and to 209,648 tons in 1917, but has dropped considerably since then on account of resumption of foreign importations, which totaled 52,483 long tons in 1921, valued at \$776,384, being then admitted duty free. Shipments from Washington were begun late in 1916; and during the following three years assumed important proportions, but only a small tonnage was shipped in 1922.

The Tariff Act of 1922, which became effective September 22nd, last year, placed the following import duties on magnesite: Crude magnesite, $\frac{5}{16}\text{¢}$ per lb.; caustic-calcined magnesite $\frac{5}{8}\text{¢}$ per lb.; dead-burned and grain magnesite, not suitable for manufacture into oxychloride cements, $23/40\text{¢}$ per lb.; magnesite brick, $\frac{3}{4}\text{¢}$ per lb. and 10% ad valorem. The figures of imports for 1922 after that date have not yet been published

by the U. S. Bureau of Foreign and Domestic Commerce, but for the nearly 10 months up to that time, the total was 112,159 long tons valued at \$1,757,636, as compared with the figures shown in the preceding paragraph.

Output and Value.

In considering mineral production, the value of the crude material is used as far as practicable. Magnesite presents a peculiar example of a material which previous to 1916 was seldom handled on the market in the crude state. It is mainly calcined and ground before being considered marketable. From 2 to 2½ tons of crude material are mined to make one ton of the calcined. In the earlier reports an arbitrary value for the crude material at the mine was calculated from the above on the basis of the calcined value, there having been very little product shipped crude. On the contrary, however, considerable tonnages since 1916 have been shipped in the crude state, contracted for at prices ranging from \$7 to \$17 per ton, f. o. b. rail points. The average was \$10.50 per ton, for 1922. This is the basis of the valuation used herein.

The production of crude magnesite in California during the year 1922 totaled 55,637 tons, valued at \$594,665 f. o. b. rail-shipping point. This is an increase over the 47,837 tons and \$511,102 in 1921.

The main hope for the future for California magnesite appears to be in the development of the plastic business, particularly in the territory west of the Rocky Mountains; and in the manufacture of refractory brick to be utilized mainly by the copper and lead smelters in the same district. It is possible that California magnesite may be sent via the Panama canal to the Atlantic seaboard; but, on account of our higher production costs, it is difficult to see how we can compete with the Grecian article at Atlantic ports.

Several plants are reported making refractory brick here from Californian magnesite. The ore from the White Rock Mine in Napa County, and that from the old Kolling (Refractory Magnesite Company) Mine, Sonoma County, is a natural ferro-magnesite and has found a ready market for refractory purposes.

In 1918, for the first time since Tulare County became an important producer of this mineral, it was surpassed in tonnage output for the year, but regained the lead in 1919, followed by Santa Clara and Napa counties, respectively. The same ranking was retained in 1920; but Santa Clara took the lead in 1921. The largest individual producer in 1920-1922 has been the Western Magnesite Development Co., in Santa Clara County, operated under lease by C. S. Maltby. A total of 24,091 tons was reported as shipped calcined by Californian mines in 1922, representing approximately 52,205 tons of crude ore.

Owing to increased building operations, and the duty on foreign importations, the outlook for magnesite is improving. Research work is being conducted by the larger operators to insure uniformity of product, and to work out formulae and mixtures for its application in the plastic trade. Present quotations (March) are reported at \$14 per ton crude, f. o. b. California points, and \$40 per ton calcined.

Production of crude magnesite for 1922, by counties, is given in the following table, with total crude value:

County	Tons	Value
Santa Clara -----	28,650	\$301,875
Stanislaus -----	2,400	35,475
Tulare -----	17,223	181,842
Fresno, Napa, San Benito, Tuolumne*-----	7,364	75,473
Totals-----	55,637	\$594,665

*Combined to conceal output of a single operator in each.

Total Magnesite Production of California.

The first commercial production of magnesite in California was made in the latter part of 1886 from the Cedar Mountain district,¹ southeast of Livermore, Alameda County. Shipments amounting to 'several tons' or 'several carloads' were sent by rail to New York; but there is apparently no exact record of the amount for that first year. The statistical records of the State Mining Bureau began with the year 1887, and the table herewith shows the figures for amount and value, annually, from that time. Shipments of magnesite from Napa County began in 1891 from the Snowflake Mine; from the Red Mountain deposits in Santa Clara County, in 1899; and from Tulare County in 1900.

Production of Magnesite In California, Since 1887.

Year	Tons	Value	Year	Tons	Value
1887 -----	600	\$9,000	1906 -----	4,032	\$40,320
1888 -----	600	9,000	1907 -----	6,405	57,720
1889 -----	600	9,000	1908 -----	10,582	80,822
1890 -----	600	9,000	1909 -----	7,942	62,588
1891 -----	1,500	15,000	1910 -----	16,570	113,887
1892 -----	1,500	15,000	1911 -----	8,858	67,430
1893 -----	1,093	10,930	1912 -----	10,512	105,120
1894 -----	1,440	10,240	1913 -----	9,632	77,056
1895 -----	2,200	17,000	1914 -----	11,438	114,380
1896 -----	1,500	11,000	1915 -----	30,721	283,461
1897 -----	1,143	13,671	1916 -----	154,052	1,311,893
1898 -----	1,263	19,075	1917 -----	209,648	1,976,227
1899 -----	1,280	18,480	1918 -----	83,974	803,492
1900 -----	2,252	19,333	1919 -----	44,696	452,094
1901 -----	4,726	43,057	1920 -----	83,695	1,033,491
1902 -----	2,830	20,655	1921 -----	47,837	511,102
1903 -----	1,361	20,515	1922 -----	55,637	594,665
1904 -----	2,850	9,298			
1905 -----	3,933	16,221	Totals-----	829,502	\$7,981,223

¹See U. S. Geol. Surv.; Mineral Resources of U. S., 1886, pp. 6 and 696.

MICA.

Bibliography: State Mineralogist Reports II, IV. Bulletins 38. 67.

No commercial production of mica has recently been reported in California. Production in previous years has been as follows:

Year	Tons	Value
1902 -----	50	\$2,500
1903 -----	50	3,800
1904 -----	50	3,000
Totals -----	150	\$9,300

"The different uses to which mica is put depend on its form—whether in sheets or in powder. Sheet mica is used in the electrical industry for glazing, and to some extent for other purposes. Ground mica is used chiefly in the decorative trades and in insulation.

"Sheet mica finds its greatest use in the electrical industry, where an insulating, noninflammable material is necessary. It is used in sheets and as washers and disks in dynamo-electric machinery, electric-light sockets, spark plugs, insulators, guards in rheostats, fuse boxes, and telephones. Flexible cloth and tape, covered with mica, find varied uses in electrical apparatus. Sheet mica is used for glazing the fronts of stoves and for making lamp chimneys and lamp shades. It is also used in spectacles, automobile shields, phonograph diaphragms, in windows where glass would be broken and in lantern transparencies.

"Ground mica is used for decoration in wall paper, to which it gives luster and brightness; in fancy paints, ornamental tiles, concrete, rubber goods, pipe and boiler coverings, insulating compounds, fireproof paints and coverings, patent roofing material, molded mica (ground mica mixed with shellac), and calico printing; as absorbent for nitroglycerin in the manufacture of 'mica powder,' in tempering steel; to a large extent as a lubricant for wooden bearings, or, mixed with oil, as a lubricant for metal bearings; and as a filler for various products. Tar and other roofing papers are coated with coarsely ground mica to prevent sticking when they are rolled for shipment. A possible value of ground mica as a chemical source of potash salts is indicated in a recent Geological survey report.²

"It is understood that sheet mica has come to be of importance as a war mineral through its use abroad as windows in masks worn for defense against asphyxiating gases, and for other uses where a transparent, noninflammable, nonshattering material is necessary, as in automobile goggles and in windows for armored cars."

Present New York quotations for No. 1 quality sheet mica are from 15c per lb. for 1½x2 inch to \$3.60 per lb. for 6x6 inch, f. o. b. North Carolina, thumb trimmed; punch 8c, other grades, 25c to \$3.25 according to size; flake 12c per lb.; scrap \$25 per ton; f. o. b. Virginia points.

MOLYBDENUM.

Bibliography: Reports XIV, XVII. Bulletin 67. U. S. Bur. of Min., Bulletin 111. Proc. Colo. Sci. Soc., Vol. XI.

Molybdenum is used as an alloy constituent in the steel industry, and in certain forms of electrical apparatus. Included in the latter, is its successful substitution for platinum and platinum-iridium in electric contact-making and breaking devices. In alloys it is used similarly to and in conjunction with chromium, cobalt, iron, manganese, nickel, tungsten, and vanadium. The oxides and the ammonium salt have important chemical uses.

The two principal molybdenum minerals are: the sulphide, molybdenite; and wulfenite, lead molybdate; the former furnishing practically the entire commercial output. Molybdenite is found in or associated with acidic igneous rocks, such as granite and pegmatite. The chief commercial sources have been New South Wales, Queensland, and Norway, with some also from Canada.

²Schaller, W. T., Mica in 1916; U. S. Geol. Surv., Min. Res. of U. S. 1916, p. 304, 1917.

³Butler, B. S., Potash in certain copper and gold ores, with a note on muscovite by George Steiger; U. S. Geol. Survey Bull. 620, pp. 227-235, 1916.

Deposits of disseminated molybdenite are known in several localities in California, and in at least two places it occurs in small masses associated with copper sulphides. The only recorded commercial shipments of molybdenum ore in California were during the war, 1916-1918. Some development work has recently been done on a high-grade deposit at the head of the Kaweah River, Tulare County.

The 1917 output included some concentrates assaying up to 58% MoS_2 , but the bulk of it was 1.5% ore which was shipped to Denver, Colorado, for concentration. That production came mainly from Shasta County, with smaller amounts from Inyo, Mono and San Diego counties. There were two concentrating plants built in California—one in each of the above first and last-named counties.

In the spring of 1918, a flotation plant operated for a short time by a lessee on the Boulder Creek mine, near Gibson Siding, Shasta County, made a small amount of 90% MoS_2 concentrate. The ore treated carried 2.6% MoS_2 . There has been none produced in California since 1918.

Present quotations for molybdenum ore are @ 65¢ per pound for 85% MoS_2 concentrates, plus duty.

The California production of molybdenum ore by years is summarized in the following tabulation:

Year	Tons	Value
1916	8	\$9,945
1917	243	9,014
1918	*	300
Totals	251	\$19,259

*300 pounds of 90% MoS_2 concentrate.

NICKEL.

Bibliography: Reports XIV, XVII. U. S. G. S., Bulletin 640-D.

Nickel occurs in the Friday Copper Mine in the Julian District, San Diego County. The ore is a nickel-bearing pyrrhotite, with some associated chalcopyrite. Some ore has been mined in the course of development work, but not treated nor disposed of, as they were unable to get any smelter to handle it for them. Nickel ore has also been reported from other localities in California, but not yet confirmed.

Present quotations for nickel are 25¢-30¢ per pound, according to grade and quantity.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections located in North America; and contains not only one or more samples of most of the known minerals found in California, but many specimens from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection. The Bureau supplies a set of forty typical minerals and ores, appropriately labeled, for study purposes to any public school in the state upon

request. During the past 30 days, a total of 431 visitors signed their names to the Museum register, and in addition there are many others daily who fail to take note of our request for their signatures.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

A total of 273 samples was received and determined during the thirty-day period covered by this report. From this number is appended a list having a possible commercial value, judging only from the samples submitted. The name and address of the sender of any of these samples will be sent upon request if the reference number is given.

The eagerly active and partly successful attempts to exterminate the boll weevil in the cotton belts has resulted in many requests being made for the determination of arsenic, phosphates and potassium. The former is being used in preparing calcium arsenic to be used as an insecticide and the latter two in the making of fertilizers for use in the cotton fields.

- 15-32 Marble (variegated).
- 15-33 Quartz.
- 15-34 Arsenopyrite.
- 15-35 Witherite (barium carbonate).
- 15-36 Sericite-schist.
- 15-37 Cobaltite (sulph-arsenide of cobalt).
- 15-38 Rutile (titanium oxide).
- 15-39 Allanite (contains didymium, yttrium, cerium, etc.).
- 15-40 Sericite-schist; also opal.
- 15-41 Amphibole asbestos.
- 15-42 Sodium sulphate.

LIBRARY.

E. COONEY, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received during the month, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geol. Survey:

Water Supply Paper No. 480—Surface Water of the United States, 1918, Part X—The Great Basin. By Nathan C. Grover and others.

Water Supply Paper No. 483—Surface Water of the United States, 1918, Part XII—North Pacific Drainage Basin, B. Snake River Basin. By Nathan C. Grover and others.

Water Supply Paper No. 508—Surface Water Supply of the United States, 1919-1920, Part VIII—Western Gulf of Mexico Basins. By Nathan C. Grover and others.

Bulletin No. 736-II—Stratigraphy of the El Dorado Oil Field, Arkansas, as Determined by Drill Cuttings. By James Gilluly and K. C. Heald.

Bulletin No. 686—Structure and Oil and Gas Resources of the Osage Reservation, Oklahoma and Structure Maps. By David White and others.

Professional Paper No. 131-D—A Geological Reconnaissance in the Gulf Coastal Plain of Texas Near the Rio Grande. By A. C. Trowbridge.

Mineral Resources:

Gold, Silver, Copper, Lead and Zinc in Nevada in 1921. By V. C. Heikes.

Mineral Waters in 1921. By W. D. Collins.

Gold, Silver, Copper, Lead and Zinc in Idaho and Washington in 1921. By C. N. Gerry.

U. S. Department of Commerce Reports February 19, 1923:

U. S. Coast and Geodetic Survey:

Serial No. 165—Utah, Washington Arc of Precise Triangulation. By C. V. Hodgson.

- Serial No. 178—Triangulation in Texas, Rio Grand Arc. By Clem L. Garner.
 Serial No. 169—Triangulation in Massachusetts. By O. P. Sutherland.
 Serial No. 177—Precise Leveling in Texas. By H. G. Avers.
 Serial No. 182—Precise Traverse and Triangulation in Indiana. By Charles A. Mourhess and Jasper S. Bilby.
 Serial No. 194—California-Oregon Arc of Precise Triangulation. By Hugh C. Mitchell and E. W. Eickelberg.
 Serial No. 204—Precise Traverse, Racine, Wisconsin to Vandalia, Illinois. By Charles Mourhess and Walter D. Sutcliffe.

U. S. Bureau of Mines:

- Technical Paper No. 301—Proposed Method for Reducing Mineral Waste in the Wisconsin Zinc District, Wisconsin. By Will H. Coghill and C. O. Anderson.
 Technical Paper No. 323—Specifications for Petroleum Products and Methods for Testing.
 Technical Paper No. 327—Accidents at Metallurgical Works in the United States During the Calendar Year 1921. By William W. Adams.

Reports of Investigations:

- Serial No. 2429—Quarry Problems from the Engineer's Viewpoint. By Oliver Bowles (Mineral Technologist, U. S. B. M.)
 Serial No. 2430—Additions, Removals and Changes in Permissible List of Explosives from March 15 to December 31, Inc., 1922. By S. P. Howell, (Explosives Engineer, B. M.).
 Serial No. 2431—Mining Diatomaceous Earth at Lompoc, Calif. By E. D. Gardner.
 Serial No. 2432—Coal Analyses from Twenty-five Laboratories Compared. By A. C. Fieldner (Superintendent, Pittsburgh Experiment Station), H. M. Cooper (Chemist) and F. D. Osgood (Assistant Chemist), U. S. B. M.
 Serial No. 2433—Metallurgical Possibilities of the Descloizite Ores at Goodsprings, Nevada. By H. A. Doerner (Metallurgist, Rare and Precious Metals Experiment Station, U. S. B. M.) in cooperation with Mackay School of Mines, University of Nevada.
 Serial No. 2434—Permissible Electric Drills. By H. B. Brunot (Junior Electrical Engineer, B. M.).
 Serial No. 2435—Explosives Used in November, 1922. By W. W. Adams, (Statistician, U. S. B. M.).
 Serial No. 2436—Effect of Cartridge Diameter on the Strength and Sensitiveness of Certain High Explosives. By Spencer P. Howell (Explosives Engineer, B. M.) and J. E. Crewshaw, (Explosives Testing Engineer, B. M.).
 Serial No. 2437—List of Publications on Ceramic Investigations, U. S. B. M.
 Serial No. 2438—Tests of Large Boiler Fired with Powdered Coal. By Henry Kreisinger (Research Engineer, Combustion Engineering Corporation, New York) and John Blizard (Fuel Engineer, U. S. B. M.).
 Serial No. 2439—Explosives Used in December, 1922. By W. W. Adams (Statistician, U. S. B. M.).
 Serial No. 2440—Subject List of Reports of Investigations Issued During 1922.
 Serial No. 2441—Report of Lignite Carbonizing Experiments Conducted at Grandforks in 1922. By W. W. Odel (Fuel Engineer, B. of M.).
 Serial No. 2442—The Use of Vapor-Tight Tankage in the Oil Fields. By Ludwig Schmidt (Assistant Petroleum Engineer, U. S. B. M.).
 Serial No. 2443—Combustion Products from a Radiant-Type Natural Gas Heater and Suggestions Regarding Its Operation. By George W. Jones, W. P. Yant and L. B. Berger.
 Serial No. 2444—Seventh Semi-Annual Motor Gasoline Survey. By N. F. Le Jeune (Assistant Chemist, B. M.) and L. G. Marsh (Asst. Chemist, B. M.).
 Serial No. 2445—The Value of Oxygen Breathing Apparatus to the Mining Industry. By E. H. Denny (Mine Safety Engineer, B. M., and Assistant Secretary of the Joseph A. Holmes Safety Association) and M. W. Von Bernwitz (Mining and Metallurgical Engineer, B. M.).
 Serial No. 2446—Rock Loading at Lime-Plant Quarries. By Oliver Bowles (Mineral Technologist, U. S. B. M.).
 Serial No. 2447—Condensation Losses Due to Transmission of Carburetted Water Gas Under High Pressures. By W. A. Dunkley (Illuminating Gas Engineer, B. M.).

- Serial No. 2448—Preliminary Investigation of Brattice Cloth Used in Coal Mining. By George S. Rice (Chief Engineer, U. S. B. M. and E. H. Denny (Mine Safety Engineer, U. S. B. M.).
- Serial No. 2449—Bureau of Mines Approval System as Applied to Permissible Storage Battery Locomotives. (First Complete Investigation Under Schedule 15). By L. C. Hsley (Electrical Engineer, U. S. B. M.) and H. B. Brunot (Junior Electrical Engineer, U. S. B. M.).
- Serial No. 2450—Petroleum Engineering in the Skull Creek Oil Pool North-eastern Osage County, Oklahoma. By T. E. Swigart (Superintendent, Petroleum Experiment Station, B. M.).
- Serial No. 2451—Coal Mine Fatalities in January, 1923. By W. W. Adams (Statistician, B. M.).
- U. S. Dept. of Commerce. Scientific Papers of the Bureau of Standards:
- No. 453—Preparation and Properties of Pure Iron Alloys. By Robert P. Neville (Associate Chemist and John R. Cain, Research Associate, B. S.).
- No. 457—Gases in Metals. 1. The Determination of Combined Nitrogen in Iron and Steel and the Change in Form of Nitrogen by Heat Treatment. By Louis Jordan (Chemist and F. E. Swindell, Assistant Chemist, B. S.).
- Scientific Papers of the Bureau of Standards—Vol. 17, 1922.
- State of Illinois Department of Registration and Education, Division of the State Geological Survey, Bulletin No. 38—Administrative Report and Economic and Geological Papers.
- Extract from Bulletin 43—Geology and Mineral Resources of the Norris Quadrangle. By Harold E. Culver.
- State of California Fish and Game Commission 27th Biennial Report, 1920-1922.
- Imperial Geological Survey of Japan Reports S5-S6-S7. Explanatory Text of the Geological Map of Japan.
- The Geology of the Yajima Oil Field.
- Industrial Mineral Survey Reports Nos. 9-10-11-12.

Societies and Educational Institutions.

- The American Mineralogist, January, 1923, and February, 1923.
- Alumni Magazine of the Colorado School of Mines, February, 1923.
- Monthly Bulletin of the Canadian Institute of Mining and Metallurgy, March, 1923.
- The Mining Congress Journal, March, 1923.
- Journal of the Western Society of Engineers, Vol. XXVIII—No. 3.
- Bulletin of the Institution of Mining and Metallurgy, February, 1923.
- Journal of the College of Science of Imperial University of Tokyo, January 24, 1923.
- The Philippine Journal of Science, January, 1923.
- Annual Report of the Academy of Natural Sciences of Philadelphia.
- Proceedings of the Academy of Natural Sciences of Philadelphia—Vol. LXXIV.

Books.

- World Almanac for 1923.
- The Petroleum Register for 1923.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

- Architect and Engineer, San Francisco.
- Arizona Mining Journal, Phoenix, Arizona.
- Asbestos, Philadelphia, Pennsylvania.
- American Petroleum Institute, New York.
- Brick and Clay Record, Chicago.
- Chemical Engineering and Mining Review, London, England.
- Cement, Mill and Quarry, Chicago, Illinois.
- Engineering and Mining Journal-Press, New York.
- Financial Insurance News, Los Angeles, California.
- Hercules Mixer, Washington, Delaware.
- Journal of Electricity and Western Industry, San Francisco.
- Metallurgical and Chemical Engineering, New York.
- Mining and Oil Bulletin, Los Angeles.
- Mining and Engineering Record, Vancouver, B. C.

Oildom, New York.
 Oil Weekly, Houston, Texas.
 Oil and Gas Journal, Tulsa, Oklahoma.
 Oil, Paint and Drug Reporter, New York.
 Oil Trade Journal, New York.
 Oil Weekly, Houston, Texas.
 Petroleum Age, New York.
 Petroleum Record, Los Angeles.
 Petroleum Refiner, Kansas City, Missouri.
 Petroleum World, Los Angeles.
 Queensland Government Mining Journal, Brisbane, Australia.
 Rock Products, Chicago, Illinois.
 Safety News, Industrial Accident Commission, San Francisco.
 Salt Lake Mining Review, Salt Lake City, Utah.
 Southwest Builder and Contractor, Los Angeles.
 Standard Oil Bulletin, San Francisco.
 Stone, New York.
 The Record, Associated Oil Company, San Francisco.

Newspapers.

The following papers are received and kept on file in the library

Amador Dispatch, Jackson, Cal.
 Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
 Bakersfield Morning Echo, Bakersfield, Cal.
 Blythe Herald, Blythe, Cal.
 Bridgeport-Chronicle-Union, Bridgeport, Mono Co., Cal.
 California Oil World, Los Angeles, Cal.
 Colusa Daily Sun, Colusa, Cal.
 Daily Midway Driller, Taft, Cal.
 Del Norte Triplicate, Crescent City, Cal.
 Exeter Sun, Exeter, Cal.
 Gateway Gazette, Beaumont, Cal.
 Georgetown Gazette, Georgetown, Cal.
 Gilroy Gazette, Gilroy, Cal.
 Goldfield News, Goldfield, Nevada.
 Guerneville Times, Guerneville, Cal.
 Healdsburg Enterprise, Healdsburg, Cal.
 Humboldt Standard, Eureka, Cal.
 Inyo Independent, Independence, Cal.
 Inyo Register, Bishop, Cal.
 Lake County Bee, Lakeport, Cal.
 Mariposa Gazette, Mariposa, Cal.
 Mining and Financial Record, Denver, Colo.
 Mountain Democrat, Placerville, Cal.
 Mountain Messenger, Downieville, Cal.
 Nevada Mining Press, Reno, Nevada.
 Oatman Mining Press, Oatman, Arizona.
 Oregon Observer, Grants Pass, Oregon.
 Oroville Daily Register, Oroville, Cal.
 Petroleum Reporter, Etna Mills, Cal.
 Placer Herald, Auburn, Cal.
 Plumas Independent, Quincy, Cal.
 Plumas National Bulletin, Quincy, Cal.
 Sacramento Union, Sacramento, Cal.
 San Diego News, San Diego, Cal.
 Santa Barbara Daily News, Santa Barbara, Cal.
 Shasta Courier, Redding, Cal.
 Siskiyou News, Yreka, Cal.
 Siskiyou Standard, Fort Jones, Cal.
 Stockton Record, Stockton, Cal.
 Sunset Journal, Sunset District, San Francisco, Cal.
 Tuolumne Prospector, Tuolumne, Cal.
 Ventura Daily Post, Ventura, Cal.
 Weekly Trinity Journal, Weaverville, Cal.
 Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of consumers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them have been made known to those looking for raw mineral products.

Sufficient publicity has not heretofore been given to this feature of the Bureau's work, but in 'Mining in California' a suitable medium is provided for current inquiries of this nature, and, therefore, written or verbal inquiries that come to the attention of the Bureau are summarized in each issue.

The name of the product wanted or offered, only, is published; the name of the owner of the deposit, or buyer, and other details being supplied upon request.

In writing, the reference number of the item should be given.

Mineral Products or Deposits for Sale.

- 12-24 Raw magnesite.
- 12-25 Shale oil for flotation purposes.
- 12-26 Barite; large deposit $1\frac{1}{2}$ miles from railroad.
- 12-27 Diatomaceous earth.
- 12-28 Quartz crystals.
- 12-29 Sericite-schist.
- 12-30 Graphite.
- 12-31 Copper-gold-silver claims; Inyo County.
- 12-32 Quicksilver claims; undeveloped; 80 acres.
- 12-33 Gold quartz prospect; $\frac{1}{2}$ mile east of Kennedy mine; 90-ft. shaft. Liberal lease and option.
- 12-34 Red marble deposit; on good road eight miles from railroad.
- 12-35 White clay and white clay-sand; short haul to railroad.
- 12-36 Yellow ochre deposit; large; three mile haul over good road to railroad.
- 12-37 Mineral paint; red; tonnage or deposit.
- 12-38 Placer property; 365 acres; Plumas County.
- 12-39 Copper deposit; large; 15 miles from Mt. Shasta. 2 to 35% copper, some silver and gold.

Mineral Products or Deposits Wanted.

- 13-23 Clay, with high alumina content.
- 13-24 Arsenic ore, capable of hand-sorting to 25% metallic arsenic.
- 13-25 Arsenopyrite or any arsenical ore; deposit.
- 13-26 Non-metallic industrial minerals.
- 13-27 Natural tourmaline crystals.
- 13-28 Magnesite; deposit.
- 13-29 Chrysotile asbestos; deposit.
- 13-30 Gold quartz property; developed, or undeveloped if existence of commercial ore can be shown. Nothing south of Tuolumne County considered.
- 13-31 Barite; deposit or tonnage. Must not contain strontium.
- 13-32 Red jasper and a hard yellow rock for roofing and stucco 'dash'; tonnage.
- 13-33 Gold placer property that is for lease or sale on easy terms.
- 13-34 Obsidian or volcanic glass; tonnage.
- 13-35 Magnesite; tonnage.
- 13-36 Mineral spring, within fifty miles of Los Angeles, that is not in use.

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of applicants for positions and 'positions open,' received by the Bureau during each 30-day period preceding the date of publication of the Monthly Chapter is carried in each issue.

Each notice is designated by a key number, and communications sent to the Bureau in reply to any notice will be forwarded to the proper party without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss.

Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

- 11-8 Superintendent or Foreman Hydraulic Mine. Thirty years experience as owner, manager or superintendent. Age 55. References. Salary wanted \$200.

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-two years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield; Auburn, and Redding. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks -----	
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks-----	
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks-----	
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks-----	
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks-----	
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. By Henry G. Hanks-----	
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.-----	
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr. -----	
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.-----	
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.-----	
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.-----	
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr.-----	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford-----	
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford-----	
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton :	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper-----	
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper-----	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper-----	.25
Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pp., paper-----	.50
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper-----	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper-----	
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915 :	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth -----	\$2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton :	
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper -----	.65
Same, including geological map of Inyo County-----	1.25
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper-----	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper-----	.65

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper-----	\$0.50
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper-----	.65
Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper-----	.65
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:	
A general Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth-----	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper-----	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper-----	.50
Mines and Mineral Resources of Sierra County, 144 pp., paper-----	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California During 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth-----	1.75
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)-----	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, December, 1919-----	Free
January, February, March, April, May, June, July, **August, September, October, November, December, 1920-----	Free
January, February, March, April, May, June, **July, August, **September, **October, **November, December, 1921-----	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922-----	Free

BULLETINS.

	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations-----	---
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations-----	---
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps-----	---
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)-----	---
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations-----	---
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations-----	.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet-----	---
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet-----	---
**Bulletin No. 9. Mine Drainage, pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations-----	---

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

Price

**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.	
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations	
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale	
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899.	
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations	
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations	
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899	
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet	
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet	
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps	
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet	
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet	
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903. 290 pp.	
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet	
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps	
**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet	
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California	
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps	
Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kuntz. 1905, 168 pp., 54 illustrations	.25

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map-----	-----
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet-----	-----
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps-----	-----
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps-----	-----
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907, 10 pp.-----	-----
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp.-----	\$0.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet-----	-----
**Bulletin No. 48. Mineral Production of California for Twenty Years, 1906, by Charles G. Yale-----	-----
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp.-----	-----
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)-----	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp.-----	-----
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet-----	-----
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet-----	-----
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by H. D. Walker. 78 pp.-----	-----
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps-----	-----
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet-----	-----
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet-----	-----
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp.-----	-----
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet-----	-----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet-----	-----
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps-----	-----
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp.-----	-----
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp.-----	-----
**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp.-----	-----
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp.-----	-----
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp.-----	-----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]-----	----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp-----	----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations-----	----
Bulletin No. 72. The Geologic Formations of California, with Reconnaissance Geologic Map, by James Perrin Smith. 1916, 47 pp-----	\$0.25
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin. 278 pp., 26 illustrations-----	----
Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations-----	Free
**Bulletin No. 75. United States and California Mining Laws. 1917. 115 pp., paper-----	----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper-----	.50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880—1917, by E. S. Boalich. 44 pp., paper-----	Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on metallurgy and ore-dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth-----	1.50
Bulletin No. 79. Magnesite in California. (unpublished)-----	----
Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)-----	----
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)-----	----
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth-----	----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper-----	Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth-----	----
Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper-----	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper-----	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper-----	----
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper-----	Free
Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leek, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth-----	\$1.25
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper-----	Free
Bulletin No. 91. Minerals of California; by Arthur S. Eakle. (in press)---	----

PRELIMINARY REPORTS.

Asterisks (**) indicate publication is out of print.

	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp. -----	----
**Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp. -----	----
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper-----	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper--	Free
Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper-----	Free
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper -----	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper -----	----

MISCELLANEOUS PUBLICATIONS.

Asterisks (**) indicate publication is out of print.

**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp. -----	
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp-----	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220. pp.-----	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp. -----	----
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. -----	----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. -----	----
**Catalogue of West North American and many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 -----	----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper -----	----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper-----	Free

MAPS.

Registers of Mines With Maps.

(**) indicates out of print.

	Price
Register of Mines, with Map, Amador County -----	\$0.25
Register of Mines, with Map, Butte County -----	.25
**Register of Mines, with Map, Calaveras County -----	
**Register of Mines, with Map, El Dorado County -----	
**Register of Mines, with Map, Inyo County -----	
**Register of Mines, with Map, Kern County -----	
**Register of Mines, with Map, Lake County -----	
**Register of Mines, with Map, Mariposa County -----	
**Register of Mines, with Map, Nevada County -----	
**Register of Mines, with Map, Placer County -----	
**Register of Mines, with Map, Plumas County -----	
**Register of Mines, with Map, San Bernardino County -----	
**Register of Mines, with Map, San Diego County -----	
Register of Mines with Map, Santa Barbara County -----	.25
**Register of Mines, with Map, Shasta County -----	
**Register of Mines, with Map, Sierra County -----	
**Register of Mines, with Map, Siskiyou County -----	
**Register of Mines, with Map, Trinity County -----	
**Register of Mines, with Map, Tuolumne County -----	
Register of Mines, with Map, Yuba County -----	.25
Register of Oil Wells, with Map, Los Angeles City -----	

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

Map of California, Showing Mineral Deposits (50 x 60 in.) —	
**Mounted -----	
**Unmounted -----	
Map of Forest Reserves in California—	
Mounted -----	\$0.50
**Unmounted -----	
**Mineral and Relief Map of California -----	
**Map of El Dorado County, Showing Boundaries, National Forests -----	
**Map of Madera County, Showing Boundaries, National Forests -----	
**Map of Placer County, Showing Boundaries, National Forests -----	
**Map of Shasta County, Showing Boundaries, National Forests -----	
**Map of Sierra County, Showing Boundaries, National Forests -----	
**Map of Siskiyou County, Showing Boundaries, National Forests -----	
**Map of Tuolumne County, Showing Boundaries, National Forests -----	
**Map of Mother Lode Region -----	
**Map of Desert Region of Southern California -----	
Map of Minaret District, Madera County -----	.20
Map of Copper Deposits in California -----	.05
**Map of Calaveras County -----	
Map of Plumas County -----	.25
**Map of Trinity County -----	
Map of Tuolumne County -----	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles -----	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin -----	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted -----	2.50

OIL FIELD MAPS.

These maps are revised from time to time as development work advances and ownerships change.

	Price
Map No. 1—Sargent, Santa Clara County-----	\$0.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos-----	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc-----	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield-----	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello-----	.75
Map No. 6—Salt Lake, Los Angeles County-----	.75
Map No. 7—Sunset and San Emido and Kern County-----	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County-----	.75
Map No. 9—North Midway and McKittrick, Kern County-----	.75
Map No. 10—Belridge and McKittrick, Kern County-----	.75
Map No. 11—Lost Hills and North Belridge, Kern County-----	.75
Map No. 12—Devils Den, Kern County-----	.75
Map No. 13—Kern River, Kern County-----	.75
Map No. 14—Coalinga, Fresno County-----	.75
Map No. 15—Elk Hills, Kern County-----	.75
Map No. 16—Ventura-Ojai, Ventura County-----	.75
Map No. 17—Santa Paula-Sespe Oil Fields, Ventura County-----	.75
Map No. 18—Piru-Simi-Newhall Oil Fields-----	.75
Map No. 19—Arroyo Grande, San Luis Obispo County-----	.75
Map No. 20—Long Beach Oil Field-----	.75
Map No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties-----	.75
Map No. 22—Portion of District 3, Showing Oil Fields, Santa Barbara County-----	.75
Map No. 23—Portion of District 2, Showing Boundaries of Oil Fields, Ventura County-----	.75
Map No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties-----	.75
Map No. 25—Kern River Oil Field-----	.75
Map No. 26—Huntington Beach Oil Field-----	.75
Map No. 27—Santa Fe Springs-----	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the State may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the State. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALI- FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the state mineralogist, as well as that of his technical staff, is also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily.

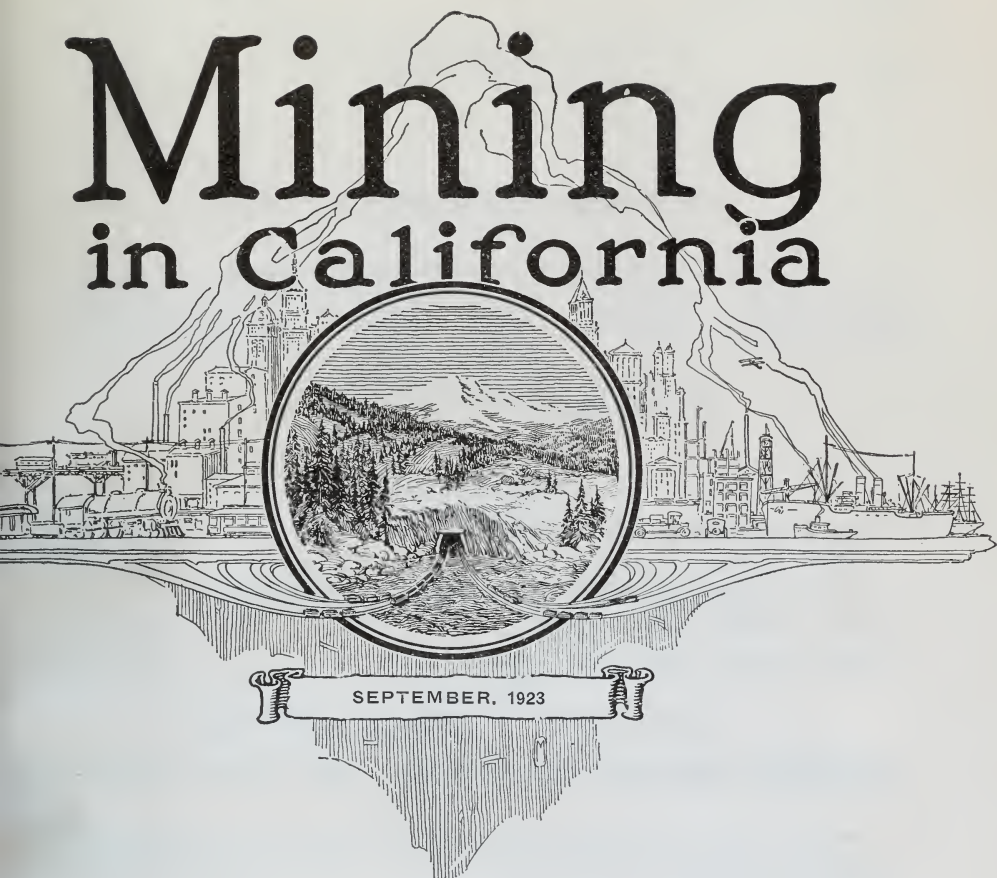
Saturday, 9 a.m. to 12 m.

LLOYD L. ROOT,

State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.
Branch Offices: Pacific Finance Building, Los Angeles; Bakersfield, Taft, Coalinga, Santa Maria, Santa Paula, Redding, and Auburn.

Mining in California



SEPTEMBER, 1923

PUBLISHED QUARTERLY
CALIFORNIA STATE
MINING BUREAU

FERRY BUILDING
SAN FRANCISCO

CALIFORNIA STATE MINING BUREAU.

EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT

State Mineralogist

WALTER W. BRADLEY

Deputy State Mineralogist

MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	-	-	-	-	Sacramento
C. MCK. LAIZURE, District Mining Engineer	-	-	-	-	-	-	San Francisco
W. BURLING TUCKER, District Mining Engineer	-	-	-	-	-	-	Los Angeles
CHAS. S. HALEY, Mining Engineer	-	-	-	-	-	-	San Francisco
FRANK SANBORN, Mineral Technologist	-	-	-	-	-	-	San Francisco

DEPARTMENT OF PETROLEUM AND GAS

R. E. COLLOM, State Oil and Gas Supervisor	-	-	-	-	-	-	San Francisco
--	---	---	---	---	---	---	---------------

NOTE.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 19

SEPTEMBER, 1923

No. 4

CHAPTER OF
REPORT XIX OF THE STATE
MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE
FRANK J. SMITH, Superintendent
SACRAMENTO, 1923

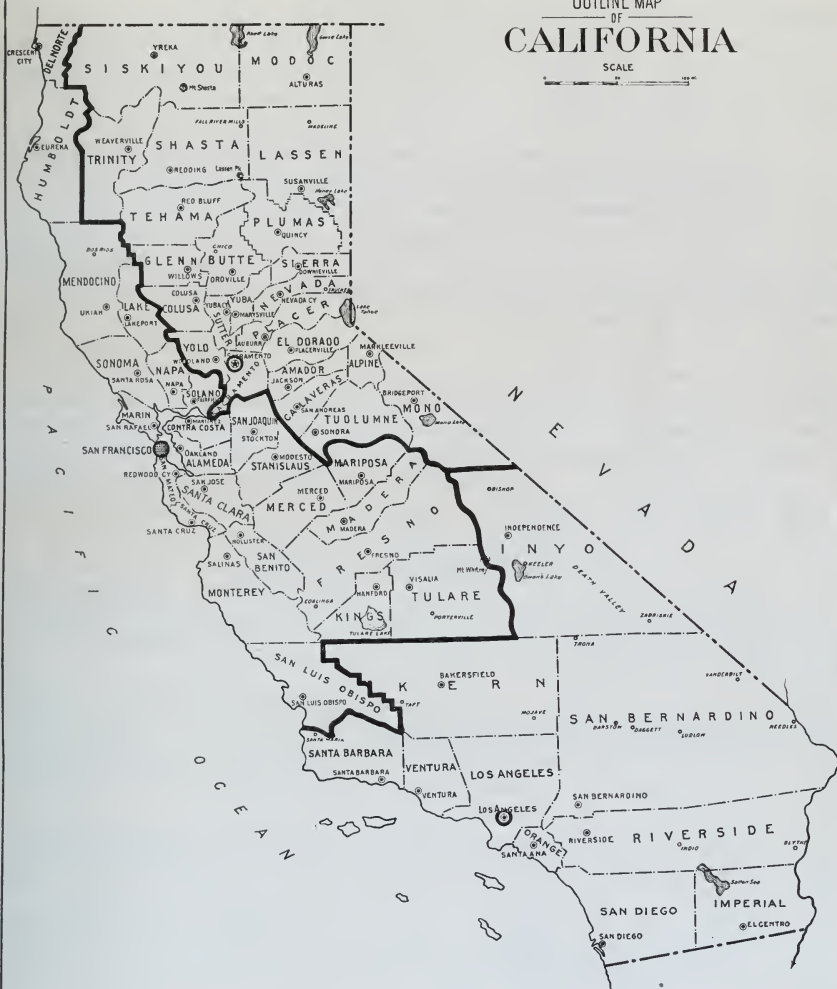
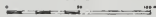
CONTENTS.

	Page
PREFACE	134
DISTRICT REPORTS OF MINING ENGINEERS.....	135
Redding Field Division.....	135
Auburn Field Division.....	140
San Francisco Field Division.....	145
Los Angeles Field Division.....	154
Oil Field Development Operations.....	174
SPECIAL ARTICLES.....	185
Clay Deposits of the Alberhill Coal and Clay Company.....	185
Oil Shale in Santa Barbara County, California.....	211
Agricultural Minerals Act.....	225
ADMINISTRATIVE DIVISION.....	229
DIVISION OF MINERALS AND STATISTICS.....	229
Statistics	229
Museum	232
Laboratory	232
LIBRARY	234
PRODUCERS AND CONSUMERS.....	244
EMPLOYMENT SERVICE.....	244
BUREAU PUBLICATIONS.....	I

CALIFORNIA STATE MINING BUREAU
LLOYD L. ROOT
STATE MINERALOGIST

OUTLINE MAP
OF
CALIFORNIA

SCALE



- LEGEND -

- Mining Division Boundaries.
- Mining Division Offices.

MEXICO

PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was begun in September, 1923.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

'Mining in California' is sent without charge to those on the Bureau's exchange list and to others who make written or verbal request.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively.

This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of conducting field work.

To continue this system most effectively with the limited funds available for the next biennium, the Redding and Auburn field offices were consolidated and moved to Sacramento on June 1, 1923.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

REDDING FIELD DIVISION.

W. BURLING TUCKER, Mining Engineer.

Lassen County.

Corona Copper Mine. The property is situated near Milford, in T. 27 N., R. 14 E., southwest of Honey Lake, near the Lassen and Plumas County line.

The mine is being developed by Marr and Fex of Milford, and it is reported that a large body of copper ore has been exposed that runs from 2 to 15 per cent copper.

Shasta County.

American Mine, situated in Secs. 12 and 13, T. 33 N., R. 7 W., on the ridge north of Cline Gulch, $3\frac{1}{2}$ miles northeast of French Gulch. Elevation, 2800 feet. Owner, W. Frank, of French Gulch. Holdings consist of the following claims: American, Wheeler and Summit, totaling 100 acres of which 60 acres are patented. The property has recently been examined by engineers representing Comstock, Nevada, interests. It is reported that a bond has been taken on the property, and that active plans of development will be started in the near future, under the supervision of Harry M. Thompson, of French Gulch. Several men are employed in repairing the road to the workings which are located on the ridge north of Cline Gulch, between Clear Creek and J. I. C.

Gulch. The workings consist of tunnels at several elevations between 2500 feet and 3500 feet.

Bibliography: State Mineralogist's Reports VIII, pp. 564-565; X, p. 637; XII, p. 245; XIII, p. 349. U. S. Geological Survey Bull. No. 540, pp. 35, 60-61.

Lewis Gardella of Oroville, dredge operator, has purchased from the American Gold Dredging Company 310 acres of land on Clear Creek.

Highland Mine. The *Iron Mountain Investment Company*, a subsidiary to the *Mountain Copper Company*, has received a patent for the Highland Lode mining claim, in Sec. 35, T. 33 N., R. 6 W., in the Flat Creek Mining District.

The Mount Shasta Silica Company, of Weed, Siskiyou County, has purchased forty-six placer claims, known as the Insulator Group. These claims are located on a large deposit of diatomaceous earth in the northeastern part of Shasta County, near Bartle Station, on the Pacific Gas and Electric Company's railroad to Pit No. 1 power plant.

Silver Falls and Chicago Consolidated Mines, are situated four miles northeast of Igo, in the South Fork Mining District, in Secs. 17, 18, 19 and 20, T. 31 N., R. 6 W., at an elevation of 1400 feet. The property is under option to the *California Bi-Metallic Corporation*, L. G. Vinson, president; Paul Drinkwitz, secretary; Louis F. Eaton, general manager. Office, 21 Carrillo Building, Santa Barbara, California.

A detailed description of this property is to be found in the July chapter of Report XVIII of the State Mineralogist, pp. 316-317.

Active development operations were started by this company the latter part of October, 1922. Since that date, a total of 1400 feet of development work has been done, including raises, crosscuts and drifts.

Mine development: At 500 feet from the portal of the main tunnel level, drifts have been driven on the Pillchuck vein for a distance of 271 feet northeast, and to the southwest a distance of 50 feet. In the drift to the southwest the face shows 3 feet of mineralized quartz. It is stated that samples taken from the vein have an assay value of \$25 per ton, in gold and silver. At the intersection of crosscut No. 36 and the drift on No. 28 vein, a raise has been put up on No. 28 vein for a distance of 155 feet, and then on an incline of 50 degrees west, and it has less than 250 feet to go on the incline to reach the surface. The vein as developed by this raise has a width of 6 inches to ten inches of mineralized quartz.

The drift on No. 28 vein has been extended 250 feet northeast. At about 380 feet from the raise a rich shoot of ore was encountered, showing from 8 inches to 2 feet of quartz. Samples taken from this shoot are said to average \$100 per ton, with \$15 in gold. The main crosscut tunnel was extended 190 feet to vein No. 36. A crosscut was driven south from No. 27 drift 30 feet to vein No. 26, then drifted northeast on this vein 120 feet.

Surface development: In the Buckley tunnel, which is on the main Chicago-Madison lode, the drift on the vein has been extended 40 feet, making a total distance on the vein of 120 feet. The shoot of ore

developed on this vein is from 80 to 100 feet in length, 12 inches to 2 feet in width, and assays from it are reported to have a value of \$65 in gold and silver per ton. About 340 feet northeast of No. 2 Wright shaft, at an elevation of 2000 feet, a tunnel is being driven north to cut the shoot of ore developed in the Buckley tunnel. This tunnel is in 80 feet, and will give about 250 feet of backs. At the collar of No. 2 Wright shaft a crosscut tunnel is being driven north to cut the main Chicago vein. The tunnel is now in 130 feet. At about 50 feet from the portal the tunnel cut two veins, which have widths of 12 inches to 18 inches, assaying \$25 to \$30 per ton in gold and silver. In the ore developed in the Buckley, and the tunnel from the Wright No. 2 shaft, the principal values are in gold, some assays showing as high as \$65 in gold with \$16 in silver.

Equipment consists of Type W. G. 6, 12" x 12" Sullivan compressor, capacity 365 cu. ft., driven by 50-horsepower Holt gas engine; high pressure blower, 12-inch outlet driven by 10-horsepower gas engine; Sullivan drill sharpener, 6 Sullivan air drills and 12 ore cars. Buildings comprise assay office, compressor house, blacksmith shop, two bunk houses, office and superintendent's residence. Twenty-five men are employed.

Bibliography: State Mineralogist's Report XVIII, pp. 313-317.

The *Sybil Mine*, which is located in Sec. 7, T. 33 N., R. 7 W., 5 miles northwest of French Gulch, recently suspended operations. The property is owned by the *Shasta Mining Company* of San Francisco, and has been under active operation for the past two years by Harry M. Thompson and associates of San Francisco, California.

The main working tunnel is driven southeast 700 feet at an elevation of 3700 feet. A winze was sunk from this level to a depth of 150 feet. At 80 feet below the tunnel a drift is driven 175 feet east, and 175 feet west on the vein.

Equipment consists of 12" x 12" Laidlaw-Dunn Gordan compressor, driven by 50-horsepower motor; 5-stamp mill, 1000 lb. stamps, and Frue vanner.

Bibliography: State Mineralogist's Report XIV, p. 777. U. S. Geological Survey Bull. No. 540, pp. 68-69.

Texas Consolidated Mine, which is situated in the Old Diggins Mining District, 9 miles north of Redding, is under lease and bond to Harvey Sallee of Old Diggins. The main working tunnel, known as No. 5 tunnel, is driven N. 10° E., 1600 feet and is 910 feet below the surface outcrop. The vein strikes N. 10° E. and dips 70° to the east, and where worked is reported to have been from 8' to 12 feet in width. The vein is faulted by a series of N. 40° W. faults, which cut off the ore. The present development work is confined to driving two crosscuts on No. 5 level, one to the east and the other to the west, located beyond the winze sunk from this level, with the idea of picking up the ore shoot that was cut off by one of these N. 40° W. faults.

Four men are employed on development work.

Bibliography: State Mineralogist's Reports, X, pp. 629, 630; XI, pp. 43, 395-397; XII, p. 258; XIII, p. 365; XIV, p. 800.

Siskiyou County.

Asbestos Group of Mines, owned by M. A. Russell, of Edgewood, has been purchased by the *National Cement Company* of Modesto. This company is planning to develop the deposit.

Eliza Mine, is situated in the Humbug Mining District, in Secs. 4, 8, 9, T. 45 N., R. 8 W., 15 miles west of Yreka. Holdings consist of five claims. The strike of the vein is N. 20° E. Vein has a width of 5 to 12 feet.

Development consists of 5 tunnels; a lower tunnel 1400 feet long and others from 100 to 800 feet in length. There is a 10-stamp mill on the property.

R. H. De Witt and associates of Yreka, owners. Plans are being made to resume operations at an early date.

Jonas Salstrom Mine and ranch, located near Orleans, has recently been purchased by the *Peacock Gold Placer Mining Company*. A crew of seven is employed by the company in building a flume from the mouth of Wilder Creek where it empties into Camp Creek.

Oregon Mine, formerly known as the *Hegler* mine, which is located on Lawson's Gulch, 12 miles northwest of Yreka, at an elevation of 3800 feet, is being developed by a 900-foot crosscut tunnel driven through Greenhorn Mountain to pick up the rich vein lost in the old workings. The general course of the vein is northeast and southwest, and it dips 70 degrees east, between slate and porphyry walls. The vein varies in width from 6 inches to 6 feet. The old workings consist of three tunnels, about 80 feet apart, from 100 to 700 feet in length.

Fairchild Mine is situated west of Hawkinsville, and is being operated by F. W. Billings, of Hawkinsville. It is reported that in recent development work a vein of quartz was uncovered, said to be 8 feet wide, with some rich ore.

Osgood Mine is situated 2 miles west of Yreka. Elevation 2800 feet. Judson C. Hubbard et al., of Yreka, owners. Holdings consist of eleven claims.

Several different vein systems occur in a belt of metamorphic slate, porphyry and schist, striking north and south, with the general trend of the range, and dipping almost vertical. The belt is interrupted and broken in many places due to local disturbances. The auriferous veins follow the strike of the belt, and are usually of narrow widths. Four of these vein systems have been cut by a crosscut tunnel 116 feet in length the pay streaks occurring in narrow seams and fractures in the zones. Oftentimes the quartz is entirely lacking in the veins, the gold being deposited along fractures in the rock. About 90 per cent of the values occur as free gold, little pyrite being found. The limits of the ore zone are well defined and are determined by panning. Most of the work is confined to the 150-foot shaft, from which it is reported over \$10,000 was taken. The shaft is intersected by a tunnel at a depth of 150 feet. Considerable stoping has been done from the 100-foot level to the surface, where the vein was evidently of good width, while little work has been done below that level.

Equipment consists of blacksmith shop, assay office, 5-stamp mill, 1050-lb. stamps, and amalgamation plates. Mill driven by 30-horse-power motor. The property is being reopened by the owners, and it is reported they plan to place the mill in operation at an early date.

Victory Gold Mining Company and the *Oak Bottom Placer Syndicate* have installed a large amount of equipment on the Victory properties, also have expended a large amount of money on the construction of flumes for hydraulicking the Oak Bottom claims on the South Fork of the Salmon River. It is reported that hydraulic operations are under way.

Trinity County.

Italian-American Hydraulic Mine, located on the Paulson Ranch, near Lewiston, is under operation. The gravel here is cemented and has to be blasted, which is done by running a system of tunnels on bed rock into the gravel bank, then forming T-drifts, loading with black powder and blasting.

One giant is under operation. Eight to ten men are employed. Season will last until July 1st.

Lorenz Hydraulic Mine, situated south of Weaverville, is under operation. Three giants are being operated night and day. The gravel bank is from 10 to 30 feet high. The ground is reported to run about \$5,000 per acre.

North and west of Weaverville, the Lorenz Bros. are also operating two giants.

The season run is about four months, and the water supply will probably enable the operators to run until July 1st. Ten to twenty men are employed. William Lorenz and Bros., of Weaverville, owners.

Pittsburg-Comstock Mines Company started hydraulic mining on their property on Canyon Creek near Dedrick, the first of May, 1923. The company has expended a large amount of money in building a water ditch and equipment, and with the monitors operating at capacity it is reported that they plan to hydraulic 5000 yards of gravel every 24 hours. The property contains approximately 1100 acres and water for the giants is delivered under a pressure of 640 feet. Water is secured from Canyon Creek through 4 miles of flume and ditch. Three known channels have been developed on the property. These channels have a general northerly and southerly course. Depth of gravel is from 30 to 80 feet, with widths of 300 to 500 feet.

Gravel consists of large boulders of schist and granite, with an overburden of red soil. Bedrock is schist. The gold is usually coarse and occurs near and on the bedrock.

The gravel is reported to average from 25 to 50 cents per yard. One 5-inch giant is under operation, on what is known as the East Channel, at an elevation of 3000 feet. Company plans to place three giants under operation during the summer. Twenty-five men are employed. Owner, Pittsburg-Comstock Mining Company. Offices, Reno, Nevada. Herbert B. Humphrey, president; A. E. Kane, secretary; T. M. Gibson, superintendent,

Unity Hydraulic Mine, situated near Minersville, on the East Fork of the Stuart Fork of the Trinity River, is being operated by the *Nugget Bar Placer Company* of Oakland. Two giants are under operation. Twenty men are employed.

AUBURN FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

Most of the time spent in field work in April was devoted to the Mother Lode report, and the following notes were taken incidentally to the above work. Much time was spent during May in moving the two former branch offices from Auburn and Redding to the new office in Sacramento.

Nevada County.

The report of *North Star Mines* for the past year's operations has lately been made public. The following items are of general interest:

Tons delivered to sorting plant-----	154,569
Tons crushed -----	115,600
Average yield, per ton-----	\$9 41
Operating cost, per ton-----	6 99
Development cost, per ton-----	1 14
Combined cost, per ton, crushed-----	8 13

Attention was called to the fact that the cost of producing \$1 in gold from this mine was 86½ cents in 1922 as compared with 54 cents for the five years beginning in 1912, the increase being attributed principally to increased costs rather than to decrease in the grade of ore. The need of developing new orebodies soon was mentioned, and the possibility of stopping or curtailing milling was discussed.

A prospecting venture of considerable interest has lately been announced at Grass Valley. For some time Roy King had believed there was a chance to pick up the extensions of some of the famous veins of the district on Alta Hill, just north of Grass Valley, where the surface is largely lava capped. The area appeared to him to be the place where the fissures should converge, if they maintain the strikes they have where worked in the big mines of the district. The *St. John* and other old quartz and gravel mines were consolidated by King as the *Grass Valley Gold Mines, Consolidated*, and the *Hilltop-Nevada Mining Co.* became interested in the project. Work was begun during April on a new vertical shaft, which, according to announced plans, will be sunk 500 feet at least and then exploratory crosscuts and drifts will be run.

Placer County.

During the spring, A. T. Thebo and associates installed equipment for placer mining on the *Sam Laird Ranch*, four miles southeast of Loomis, and began digging late in April. The deposit is the wide shallow portion of an old channel, and has little grade. An attempt to work it by hydraulic elevator some years ago was not very successful on account of the peculiar configuration of the bedrock and the difficulty of moving the equipment from one set up to another.

The present equipment comprises a drag line scraper with capacity of one cubic yard, gin pole, two steam engines of about 45-horsepower each, a 40-foot hopper, 260 feet of sluice with a grade of 8 inches in 12 feet, and 70 feet of tail sluice. Using several hundred feet of cable, the scraper delivers its load to the hopper, which is set high to furnish room for grade for the sluice and dump room for tailing. Water for washing the gravel is pumped to the head of the sluice by a centrifugal pump operated by one of the steam engines and furnishing at the time of visit about 75 inches. Operations were just getting under way at the time of visit and the actual working capacity of the scraper and the grade of the gravel were matters of uncertainty. Six men were employed. Crude oil, hauled from Sacramento, was being used for fuel and Thebo stated the cost of operating with this power compared favorably with the cost of electricity, although an electric line passes within half a mile.

An expensive flume has been built lately to convey water for power at the *American Bar Quartz claims* on the Middle Fork of American River, 2 miles south of Michigan Bluff. Development work is reported to be giving encouraging results.

F. A. Moss is continuing work in the prospect adit of the *Blue Eyes* property in Duncan Canyon and reports conditions indicate the nearness of the channel.

El Dorado County.

Big Buzzard Mine is in the SE $\frac{1}{4}$ of Sec. 29, T. 11 N., R. 8 E., fourteen miles from Auburn. It is owned by Mrs. Jane Darrington, Geo. and Bert Darrington and J. P. Foster. It has been worked in a limited way for many years, but the total amount accomplished has been small, due to limited funds and frequent shut-downs. The property includes a full claim and a south extension of 1000 feet. The vein dips east and strikes north to northwest.

An inclined shaft on the vein has been sunk 267 feet, with levels at 70, 160 and 260 feet. On the 70-foot level, a drift was run north on a curving course for 80 feet and a stope about 45 feet long, 35 feet high and 5 feet thick was worked. On this level south, a drift has been run 40 feet and a thickness of 8 to 10 feet was stoped to a height of 25 feet and a length of 20 feet. The ore from the south stope is said to have returned about \$14 a ton in gold, without saving the concentrate, and a little sorted ore from this stope showed satisfactory amounts of silver, copper and lead also. The results from the north stope as reported by the owners showed about one-half as much gold as on the south. On the 160-foot level north, 40 feet from the shaft and within 10 feet of the face, a dike a foot wide cuts across the vein, and from what can be seen, may mark the north boundary of the shoot. On the south on this level the drift is in 36 feet and shows heavy complex sulphide ore the width of the drift. Similar ore occurs in the shaft from here to the sump. The ore-shoot appears to be pitching south and to be principally south of the shaft, but there has not been sufficient drifting in this direction to show the extent of ore. The hanging wall on the 260-foot level is broken and heavy, white mica-schist and the foot-wall is smoothly polished, hard amphibolite-schist. There is only 15

feet of drifting on the 260-foot level, in a northerly direction, and the heavy ore is in evidence here on the south side of shaft. Besides the crushing of the hanging wall, there has been some post-mineral movement on the footwall and within the vein about two feet from the foot-wall.

The mine shows several kinds of ore, with pyrite, chalcopyrite, galena and zincblende. The heavy complex ore carries a good deal of zincblende, and the values are reported to be capriciously distributed, as far as assays show. What system of treatment will be finally adopted to mill the ores of the mine has not been determined, but flotation tests are reported to have given satisfaction, and differential flotation may solve the problem. There is a 5-stamp mill which has not given good results. The hoist is operated by a 19-horsepower gas engine. A perpetual water supply could be pumped from the river, one-half mile distant and 400 feet lower. Electric power is about 6 miles distant.

Jones Mine is near Diamond Springs and is east of the Mother Lode on a quartz stringer a few inches wide, striking east. It has made some production as a pocket mine previous to present operations. It was reopened in 1922 by J. M. Brown, Mrs. Allie Lange and others of Bakersfield. Since reopening, it has made a few thousand dollars production in pocket gold, which is recovered by rocking. The pay appears to have been deposited where the vein approaches dikes which run with the general course of the country rocks, northwest.

There is a shaft with three levels at 75, 165 and 225 feet depth. There was about 500 feet of drifting on the first level, 100 feet each east and west on the second, and drifts were just being started late in March on the third level. The property is equipped with one 25-horsepower and one 10-horsepower gas engine, 9-inch by 8-inch air compressor, hoist and improved jackhead pump. About 60 gallons of water is pumped per minute.

Jumbo Placer Mine is a creek placer a mile west of Clarksville. It was formerly known as the *White Rock Land and Mineral Company*. It comprises 80 acres, of which possibly one-fourth or less is a shallow gravel deposit along the meandering course of Carson Creek. The ground has been worked in part by sinking shafts to bedrock and drifting out small areas as long as the ground would stand without timber, and in part by surface placering. The gravel is 8 to 15 feet deep.

H. S. Brinley of Seattle has taken a Marion No. 31 drag line scraper outfit to the property and on June 12 was preparing for a trial run. The scraper outfit is on a caterpillar mount and the bucket works from a 50-foot boom, making it possible to work a strip 120 feet wide, and the set-up can be changed in 3 hours, making for much greater mobility than with the scraper working from a gin pole.

There is a scarcity of water in summer on the property, and after the test run it is not likely that much can be done until the winter storms begin. Water will be pumped to the sluices from a reservoir. The scraper will deliver to a hopper at the head of the sluices, raised enough to give dump room, and tailings will be stored in the worked-out pits.

A gasoline engine and pump have been taken to the *Lukens Mine*, three and a half miles from Cool on the east side of American River, to

unwater the old workings and investigate the prospect said to have been left in the bottom. A. M. Dunlop of Auburn is in charge of work.

There are two shafts on the property, 150 feet apart, and 60 and 90 feet deep, respectively, being connected by a drift. The small vein has yielded some high grade ore, but there is no exact record of the amount.

Work is going on at the *Sliger Mine* near Spanish Dry Diggings, preparatory to an announced reopening. The Sliger was found in 1864 and was noted as a producer of rich ore. The Sliger patent contains only 5 acres, covers 530 feet on the vein, and was worked to a depth of 298 feet and a length of 231 feet, according to the owner's records. Ore to a depth of 200 feet and a length of 160 feet is supposed to have been milled. There was a 5-stamp mill on the property in the seventies.

Amador County.

The main shaft at the *Argonaut Mine* has been concreted to a depth of 40 feet and the hoist has been set on new concrete foundation. Unwatering is reported completed.

The Elephant Deep Hydraulic Mine at Volcano has been in operation lately under lease.

Twenty stamps of the mill are in operation at the *Fremont Mine* and Superintendent B. I. Hoxie reports that lack of labor is the only hindrance to operating on a larger scale.

Work was begun in April on the Big Tunnel of the *Mammoth Mine* south of Jackson near Mokelumne River. This was one of the mines worked by Captain Nevills, thirty-six years ago.

Moore Mining Company has been reorganized, with several changes in personnel. The company was having trouble keeping the mill supplied with ore and at the same time carrying on necessary development work. Plans for deepening the shaft and opening new ground have been announced.

Wait Marble Deposit. A. L. Wait of Plymouth has a deposit of red marble on the Drytown-Sacramento road, three miles from Drytown and eight miles from the railroad at Carbondale. The marble outcrops beside the road over an area 160 feet by 400 feet. A pit opened here would have to be pumped as the surface is flat. The stone has a very pleasing dark red color when polished. The deposit has never been drilled or otherwise prospected, so nothing is known of its depth or tonnage.

Tunnel Hill Ochre Deposit is three miles by road from the railroad at Martel, near the Mokelumne Hill road. A. F. Roberts of Jackson has a five year lease. This is a large deposit of yellow ochre, forming the bedrock of an old hydraulic mine. One or two small shipments were made several years ago for testing purposes, but there has been no work since.

Calaveras County.

La Fortuna Mines Company, a trust corporation, 316 Hobart Building, San Francisco, have begun work on the *Lucas Mine* on Mokelumne River, one-half mile upstream from the Jackson-Mokelumne Hill road.

This is an old property, formerly productive. It contains three claims, one on the Lucas vein which has been developed, and two on the parallel Pilot vein to the east.

The Lucas vein strikes nearly north and dips 60 to 65 degrees west, in diorite. It has been developed by an adit which is a crosscut 260 feet to the vein, then drifted south 574 feet on the vein. A winze was sunk from the drift 440 feet from the portal to a depth of 131 feet on the vein, giving a total depth of 273 feet on the vein. In the winze 60 feet below the adit a level was turned and drifted 108 feet north and 109 feet south, with a crosscut 22 feet east in the north drift. The vein is of good width in the adit and has been stoped thence to the surface for a length of 285 feet. In this distance two ore shoots are reported, the North shoot 65 feet long and the Mexican shoot 106 feet long. While the present operators report that the vein assays fairly well here for a distance of 405 feet, it would appear from their records that the pay ore was in these two shoots. Veins striking southeast and dipping southwest cross and fault the main vein a few feet, and the ore appears to occur at and near these crossings. The last ore milled is claimed to have plated \$6.35 a ton, but no definite record is available. The winze was full of water at the time of visit, but it was stated that the vein has an average width of $3\frac{1}{2}$ feet of white quartz in the 60-foot level, assaying on an average much lower than in the adit above. The east crosscut on the lower level was started to follow one of the cross veins found above, and the low assays might be due to this level not having been run to the larger shoot, if the length stated for the drift is right.

The property is supplied with electric power from a line passing the adit. It is equipped with a 5-drill air compressor, 40-horsepower motor and air drills and small buildings. A pump was to be installed to unwater the winze.

Maloney Prospect, adjoining the town of Mokelumne Hill, is to be prospected by John Seip and associates. The claim contains a wide, solid quartz vein, which strikes north and dips 80 degrees west, with a cross vein. Both veins have been worked only a little near the surface by pocket hunters.

Disappointing results have been reported from the *Red Hill Gravel Mine*, $2\frac{1}{2}$ miles from Mokelumne Hill. After starting work on a flattering prospect that appeared to be in new ground, old workings are said to have been encountered, of which there was no record, where early day miners had removed the best gravel.

Tuolumne County.

A 2-stamp mill, concentrator and compressor have been put on the *App Mine* and some ore is being crushed from shallow workings. C. W. Ayers, D. E. McPherson and J. A. Keyes are interested.

Encouraging reports continue from the *Casa Madera* prospect on the East Belt in the Confidence district. This is so far a surface showing but the company has great faith in it and has placed a large order for lumber for buildings.

Nevada Wonder Mining Company has abandoned the option on the *Chileno* and other claims of a large group on Jackass Hill near Tuttle-town. As soon as they quit, the Chileno was taken under lease and

option by L. L. Coffey and G. L. Warrington. They were getting an old stamp mill in shape and putting in a Huntington mill late in March, preparatory to stoping and milling ore from the 150-foot level.

The Chileno was opened to a depth of about 500 feet on a 74-degree incline by the former company, and levels were run at 150 and 450 feet. An ore shoot of very good width and tenor and about 160 feet long was opened on the 150-foot level. On the 450-foot level over 1000 feet of work was done, of which over 500 feet was crosscutting. This level did not come up to expectations. They also drove the Bailey crosscut adit over 500 feet southwest and south toward the Chileno, but found no ore although several barren veins were cut.

The long drift being driven northward from the *Crystalline* under the *Alabama* property had reached a point at the end of March where the *Tonopah Mining Company* expected to begin the real prospecting of the Alabama claim, for the downward extension of the Alabama ore shoot. This work will be done in the area under the old shaft, and on the 600-foot level. This level is also being run on the south, under the *Crystalline* group. No conclusive results have been reported yet from these properties, as attention has been devoted to running the drift, and crosscutting is yet to be done to explore the country on the two sides of it. Since the above was written, the company is reported to have quit work.

Omega Mine, adjoining the Alabama on the north, was unwatered by the end of February and at the end of March the shaft had been repaired and work was being done upon the 600-foot level, clearing out and catching up ground preparatory to exploration. P. A. Herivel of Jamestown is in charge.

Sonora Wonder Mine, beside the state highway about a mile below Sonora, is being prospected by W. J. Woolsey. A light prospecting hoist and small engine are in use and late in March the shaft was down about 70 feet. A good prospect is reported.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

Mendocino County.

COAL IN MENDOCINO COUNTY.

Historical:

The occurrence of workable bodies of coal in Mendocino County has been known for many years. Reports made more than fifty years ago are available describing the deposits and containing analyses of the coal. Goodyear,¹ in his report published in 1877, referring to known California coal localities says:

"Fourth. On the Middle Fork of the Eel River about seven or eight miles south of the village of Round Valley in Mendocino County, and in the northwest corner of section 11, T. 21 N., R. 13 W., M. D. M., there is a bed of coal exposed crossing the channel of the river in a direction N. 45°-50° W. magnetic and dipping from 20°-30° northeast.

"This bed is from fourteen to fifteen feet thick and is all good coal, with the exception of a single streak of shale in the middle of it, about five or six inches in thickness. * * *

¹Goodyear, W. A., Coal Mines of the Pacific Coast. Bancroft & Co., publishers, San Francisco, 1877.

"The quality of the coal itself is a little better than that of the Mount Diablo mines. In fact it is the best coal which I have seen from anywhere in California; while at the same time it is the thickest bed of a marketable quality of coal that is yet known to exist within the state."

Another early report on the Eel River coal deposit is found in 'Mineral Resources West of the Rocky Mountains,' by R. W. Raymond, U. S. Commissioner of Mining Statistics, 1875. At that time, it will be noted, the deposit was practically isolated. The Raymond report, in part, states:

"The Mount Vernon Coal Mine is situated on both sides of Middle Eel River (a mountain torrent), in townships 21 and 22 north, range 13 west, Mendocino County, California, and lies northwesterly from Ukiah, distant in an airline, thirty-eight miles, and about sixty miles by the county road, which has been constructed from Ukiah City to Round Valley, a government military station. This road at its crossing of Middle Eel River passes within two miles of the Mount Vernon Mine and there is a good trail along the riverside from the road to the property. Noyo is its nearest seaport. A circuitous road forty-two miles long connects the two places. The projected line of the North Pacific Railroad (a California enterprise) passes within four miles of the mine, crossing at the junction of Middle and South Eel rivers. The property consists of 7200 acres of land.

"No work of importance has as yet been done to develop the resources of this coal field. The value of the property can only be prospectively estimated. The coal has been traced six miles. The land is admirably located with reference to the strike and dip of the coal as shown by its various outcroppings. All the property on which the coal is exposed and the land into which it dips are covered by United States patents.

"Commencing at a point about one mile south 35° east from the coal outcrop in the river, the coal first makes its appearance in a creek on the side of a steep hill, covered by a thin layer of shell limestone broken up and mixed with decomposed shale and soil colored red with ferruginous matter. Tracing along the line of the croppings north 35° west to the banks of the river, over undulations caused by landslides, which gradually flatten as the stream is approached, and in which detritus and boulders of all sizes lie scattered in profusion, an immense body of coal is found, entirely denuded of all its encompassing strata. For nearly 600 feet in length, with a height of 14 feet, a body of coal is exposed, forming an abrupt bluff, over which the water runs, occasionally detaching huge masses of coal from the outcrop and hurling them down the stream. * * *

"The thickness of the strata as here exposed is about 20 feet. High water prevented the accurate measurement of the bed. Actual measurement, where practicable, showed 14 feet of coal in the stream, and a calculation of the thickness of this bed from the encompassing walls showed it to have been 20 feet through, from 5 to 6 feet having been washed away. These immense croppings extend across the river, a width of 350 feet. The banks on both sides being low, the coal beyond the river gradually enters the detritus and soil, and for a distance of several hundred feet southeast lies only a few feet underground. A crosscut made on the surface 400 feet from the river on the northwest side, is said to have shown a solid stratum of coal 20 feet thick. The coal in the river lies between two strata of gray argillaceous shale. The edges of the upturned strata have slacked and assumed a reddish brown color. The shale underlying the main coal-bed contains several seams of coal, varying in size from 1 to 8 inches. The exposed thickness at the surface of the shales underlying the coal is about 19 feet, the dip being 21 degrees. The shale is succeeded by a thin bed composed of fossil oyster shells, some of which are very large. A soft yellow and brown sandstone, partly disintegrated, underlies it.

"An examination of the overlying shale on the southeast side of the river, below high-water mark, and a foot below the surface, showed it to be of grayish color, hard, compact and of such a nature as will form a strong and solid roof, impervious to water, and a great protection for the future working of the mine. Overlying the shale is sandstone, soft and totally disintegrated, and along the banks of the river detritus and metamorphosed rock overlie the sandstone. * * *

"Three-quarters of a mile northwest of the river croppings, under an abrupt bank (the sides of which have been cut and washed away) at an altitude of about 200 feet, a bed of coal 6 feet thick has been exposed. * * * Three hundred feet above these croppings, about a mile and a half northwest of the river croppings, coal again shows itself in a mountain creek, issuing from an abrupt bank of columnar sandstone about 60 feet high. Black dirt and fragments of coal on all sides, embedded in a whitish clay, indicate the presence of coal. No definite stratum has here been found; nor has the ground been prospected. Crossing to the north the ridge of sandstone, shale and detritus, and descending on the opposite side of the hill, a distance of four and a half miles from the croppings in the river, coal again makes its appearance on the side of a creek. * * * Northwestly for half a mile the coal can still be traced.

"The coal is hard and bituminous. It burns freely and with a bright flame, gives a good compact coke, and leaves but little ash. A proof of its purity is the circumstance that the water which pours over it from the springs remains pure and drinkable. The coal gives a strong heat and will prove an excellent coal for generating steam, producing gas,¹ and for domestic use.

"Although exposed to the action of the air and water, it does not slack to any great extent, but remains remarkably hard and compact. From repeated experiments with it in large quantities, a mere trace of sulphur is perceptible.

Analysis of coal from vein running through Eel River to Round Valley: S. W. Glazier, Esq (for the company).

"Dear Sir: I have made a careful analysis of a specimen of coal received from you and have arrived at the following results:

"Specific gravity -----	1.282
Volatile combustible substance-----	40.20 per cent
Fixed carbon -----	49.70 per cent
Moisture -----	6.70 per cent
Ashes -----	3.00 per cent
Sulphur -----	0.40 per cent

"Amount of gas evolved, 37 cubic feet for 10 pounds Avd. of the coal.

"The coal burns freely, yields a fire light and compact and sonorous coke, and its ashes are of a reddish gray color and do not slag.

"The amount of sulphur is so minute that it does not make itself perceptible to the smell in burning the coal.

Respectfully yours,

L. FALKENAU, State Assayer.

"San Francisco, December 8, 1870."

In a detailed report on the Chemical Examination of Pacific Coast Coals made in 1872 by S. F. Peckham,² the author gives the results of analyses of 20 samples of foreign and California coals. This table is here reprinted in full:

TABLE OF ANALYSES OF PACIFIC COAST COALS.

Nos.	Locality	Specific gravity	Volatile under 250° (water)	Volatile under white heat	Fixed carbon	Total combustible	Ash
California:							
59	Black Diamond, Monte Diablo-----	1.4150	13.015	42.15	34.235	76.385	10.600
63	Black Diamond, Monte Diablo-----	1.3491	13.08	42.93	38.855	81.785	5.135
62a	Clark Bed, Monte Diablo-----	1.3539	11.64	45.67	34.555	80.225	8.195
60	Union Mine, Monte Diablo-----	1.3143	11.56	47.365	34.43	81.795	6.645
61	Stewart's Mine, Monte Diablo-----	1.3613	12.82	46.915	53.59	80.505	6.675
56	Corral Hollow, Alameda County-----	1.4321	15.015	41.435	30.805	72.240	12.745
57a	Eel River, Mendocino County-----	1.3596	8.14	45.54	38.67	84.210	7.660
57b	Eel River, Mendocino County-----	1.3571	8.595	47.315	37.485	84.800	6.605
57c	Eel River, Mendocino County-----	1.3820	8.555	48.51	37.88	86.390	5.055
Pacific Coast, north of California:							
51	Bellingham Bay-----	1.4151	7.375	39.85	38.655	78.505	14.120
52	Nanaimo, Vancouver Island-----	1.3492	2.795	43.125	42.055	85.180	12.025
53	Comox, Vancouver Island-----	1.3401	2.015	32.73	56.14	88.870	9.115
62	Queen Charlotte Island-----	1.6781	1.18	17.25	49.835	67.085	31.735
54	Coos Bay, Oregon-----	1.4150	9.13	36.51	46.705	83.215	7.655
65	Nanaimo, New Co., Rosenfeld and Birmingham-----	1.3144	3.565	40.195	56.54	90.735	5.750
68	Seattle, Washington, Territory-----	1.3919	13.85	38.375	41.74	80.115	6.035
Foreign:							
53	Lata, Chili-----	1.3043	3.545	43.885	43.915	87.800	8.705
66	Saghalien, North Pacific-----	1.3136	1.925	36.61	52.80	89.410	8.665
67	Los Bronces, Mexico-----	1.7227	7.38	4.005	85.385	89.390	3.230
64	Sydney, Australia (Wall's End)-----	1.3471	3.01	31.165	55.56	86.725	10.265

¹Yield of gas per ton of coal, 11,250 cubic feet; illuminating power of gas, 15.3 candles; carbonic acid, 7 per cent.—London Analysis.

²Peckham, S. F., Chemical Examination of Pacific Coast Coals. Geological Survey of California, Economical Geology of the Coast Ranges; Vol. II, Geology.

Commenting on the results shown, Peckham continues:

"Arranged according to the total amount of combustible material that they contain, their relative value would appear as follows:

1. No. 65 (Nanaimo)	90.735 per cent
2. No. 66 (Saghalien)	89.41 per cent
3. No. 67 (Los Bronces)	89.39 per cent
4. No. 55 (Comox)	88.87 per cent
5. No. 53 (Chili)	87.80 per cent
6. No. 64 (Sydney)	86.725 per cent
7. No. 57c (Eel River)	86.39 per cent
8. No. 52 (Nanaimo)	85.18 per cent
9. No. 57b (Eel River)	84.80 per cent
10. No. 57a (Eel River)	84.21 per cent
11. No. 54 (Coos Bay)	83.215 per cent
12. No. 60 (Union Mine)	81.795 per cent
13. No. 63 (Black Diamond)	81.785 per cent
14. No. 61 (Stewart's Mine)	80.505 per cent
15. No. 62a (Clark Bed)	80.225 per cent
16. No. 68 (Seattle)	80.115 per cent
17. No. 51 (Bellingham Bay)	78.505 per cent
18. No. 59 (Black Diamond)	76.385 per cent
19. No. 56 (Corral Hol'ow)	72.240 per cent
20. No. 62 (Q. Charlotte Island)	67.085 per cent

Nos. 1 and 2 are caking coals. No. 3 is an anthracite. Nos. 4 and 5 are caking coals. No. 7, a noncaking coal, appears to be more valuable, and Nos. 9 and 10 but little less valuable than No. 8; but this inference may not be a fair one, * * *. In Nos. 7, 9 and 10 the percentage of this volatile matter (water volatile under 250°) is two and one-half times greater than in No. 8, while the percentage of ash in No. 8 is nearly twice that found in the others; yet No. 8 may be much more valuable than either of the three."

The following data on Eel River coal are taken from a table of analyses of California coals published in Report XII of the State Mineralogist, 1894:

Locality	Color of powder	Color of ash	Cok- ing quali- ties	Water	Volatile matter	Fixed carbon	Ash	Author- ity
Middle Fork Eel River: Main tunnel----	Glistening black, brown tinge--	White-----	None	8.00	39.25	46.25	6.50	Mathyas
Incline, 20 feet down, cropping in river-----	Glistening black, brown tinge--	Reddish white	None	7.50	17.75	47.75	27.00	Mathyas
Top streak-----	Glistening black, brown tinge--	Reddish white	None	6.75	40.00	47.50	5.75	Mathyas
Bottom streak--	Glistening black, brown tinge--	Reddish white	None	6.25	31.50	46.25	16.00	Mathyas

Two analyses and tests made by Louis Falkenau, state assayer, and by Thos. Price & Son, respectively, in August, 1890, are appended:

"No. 14,357

"San Francisco, August 2, 1890.

"J. L. Flood, Esq.,

"Dear Sir: I have made a careful technical analysis of a sample of coal received from you, marked 'Eel River Coal Mine, Mendocino County,' and a sample marked 'Wellington,' with the following results:

	Eel River	Wellington
"Specific gravity -----	1.302	1.300
Moisture -----	7.9 per cent	2.4 per cent
Volatile combustible -----	36.2 per cent	33.45 per cent
Fixed carbon -----	53.5 per cent	58.6 per cent
Sulphur -----	0.4 per cent	0.15 per cent
Ashes -----	2.0 per cent	5.4 per cent

"The cokes furnished by the two coals (sample of which I hand you with this report) are the same in appearance, but that of the Eel River coal contains 3.6 per cent of ashes, while that of the Wellington contains 8.4 per cent.

"The Eel River coal weighs 81 pounds per cubic foot and in place 24.7 cubic feet will weigh a ton of 2000 pounds, but to store a ton, about 42 cubic feet will be required.

"As the sample of Eel River coal is, according to your statement, from the surface exposed to extraneous moisture, it is to be assumed that the coal at greater depth will contain much less moisture. If the Eel River and Wellington are both figured to dry coal, their carbon compares as follows:

	Eel River	Wellington
"Volatile combustion -----	39.73 per cent	34.42 per cent
Fixed carbon -----	58.19 per cent	60.04 per cent
Total carbon -----	97.92 per cent	94.46 per cent

"From the foregoing I consider sample of Eel River coal as equal to the Wellington for domestic use and as fuel for steam boilers.

Yours respectfully,

(Signed) Louis Falkenau."

"August 11, 1890.

"Analysis of Two Samples of Coal for Geo. R. Wells, Esq.

	"A"	"B"
"Water -----	6.70 per cent	2.55 per cent
Volatile carbonaceous matter -----	52.89 per cent	62.01 per cent
Fixed carbon -----	38.66 per cent	29.64 per cent
Ash -----	1.75 per cent	5.80 per cent
	100.00 per cent	100.00 per cent
Sulphur -----	2.49 per cent	1.81 per cent

"The sulphur is present in the form of sulphates of lime.

"By the combustion of two samples of coal of 1 pound each, the following quantities of water were evaporated:

"Sample 1—13.86 pounds. Sample 2—12.8 pounds.

"Both samples form a good soft coke.

Thomas Price & Son."

Development:

From 1870, or earlier, to 1922, the Eel River coal deposits have remained practically undeveloped and one may reasonably ask, "Why has a vein of coal, of the size and quality indicated by the surface exposures and analyses, not been developed during all this time, and the coal placed on the market?"

During the '70s, at the time the coal industry of the state reached its maximum development and the coal mines of the Mount Diablo district were in active operation, lack of transportation facilities and distance from market doubtless prevented economic exploitation of the Mendocino County area. Tunnels and other openings made in the early days have been abandoned and have long since caved or been obliterated by landslides. The prominent ledge in the river bed described in early reports has also been eroded away and the outcrop nearly covered with debris brought down by the river during high water.

The production of petroleum in California began about 1874, and the steady growth of the oil industry which has supplied an abundance of cheap fuel, has caused little attention to be paid to California's coal deposits. Most of these have been looked upon from the first as being of inferior quality, and under the circumstances offering but little inducement for the investment of capital.

Furthermore in the Eel River district the most prominent exposures and the greater part, if not all, of the known coal land was covered by

United States patents and included in a tract of 7200 acres, that early passed into the hands of strong financial interests headed by the James L. Flood estate, this tract being known as the Flood Ranch.

The owners of this property have not been particularly interested in developing the coal deposit and for various reasons have made no effort to place their property on a producing basis.

This inactivity on their part has retarded development of the entire Eel River field and it was not until early this year (1923) that a serious effort was made to develop a producing coal mine in this district.

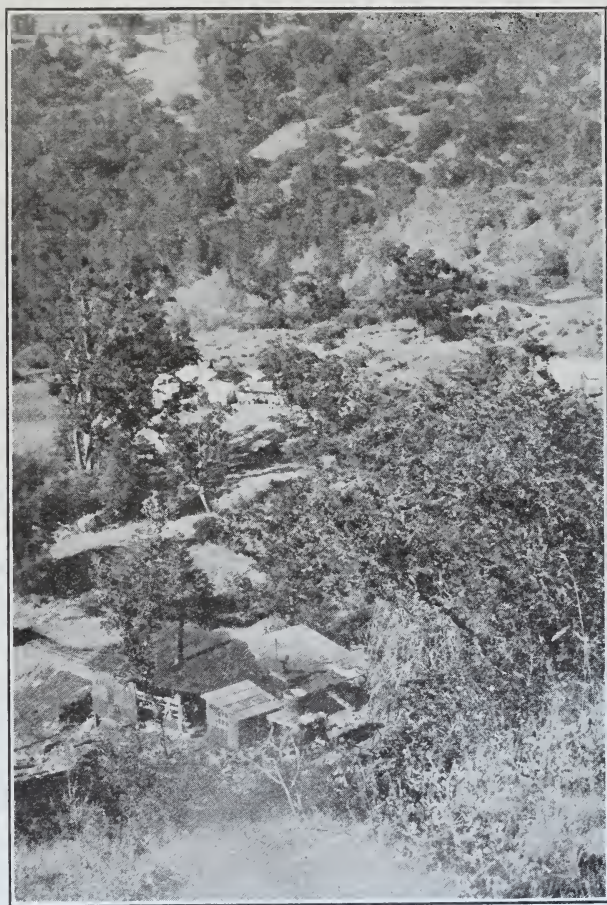


Photo No. 1. Camp and Surface Works. Camp Carbon Coal Mine, Mendocino County, Cal.

Camp Carbon Coal Mine (formerly the Thomas Mine).

This property contains 1040 acres and includes the SE $\frac{1}{4}$ of Sec. 13; the E $\frac{1}{2}$ of Sec. 24; the E $\frac{1}{2}$, the NW $\frac{1}{4}$, and the N $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 25, all in T. 21 N., R. 13 W., M. D. M. At its nearest point it is nearly due south and about 2 miles distant from the coal outcrop in the Eel River at the mouth of Salt Creek. The property extends north and south 2 $\frac{1}{2}$ miles, varying in width from one-half to one mile.

The Eel River coal was traced south of the river soon after the original discovery and an outcrop noted on this property near the center of the section line common to sections 13 and 24. A few prospect holes were dug on section 24 in this vicinity and later, about 1903, a tunnel was run southwesterly for a distance of 70 feet. This tunnel

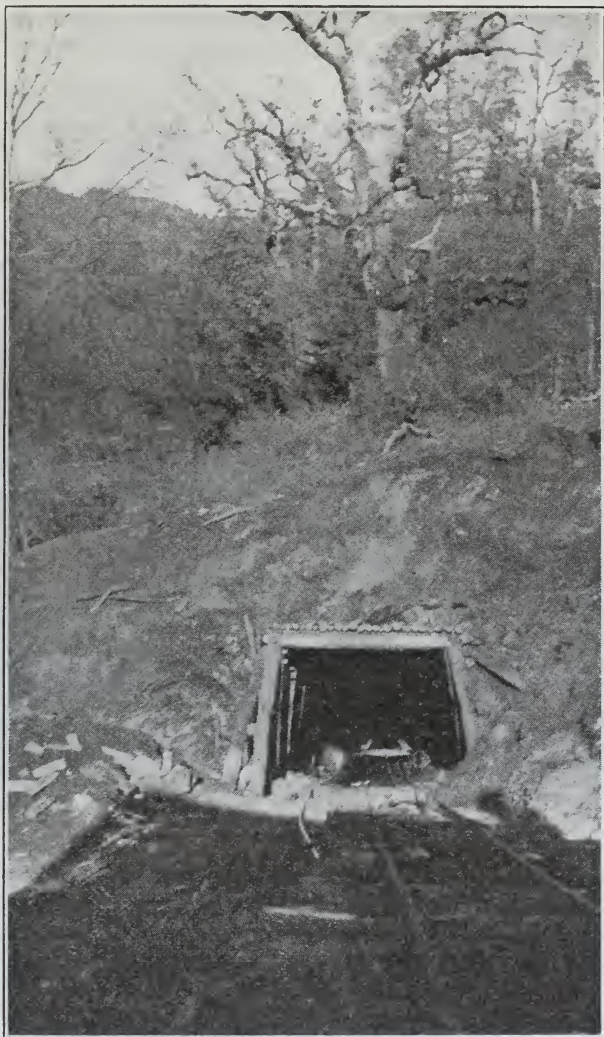


Photo No. 2. Main entry, looking east. Camp Carbon Coal Mine, Mendocino County, Cal.

was almost entirely in coal, but its direction was practically parallel to the outcrop. After demonstrating the occurrence of a good size vein at this point it was allowed to cave and no further development was attempted pending the opening up of the deposit on the Flood Ranch, nearer the river.

During the past year the latent possibilities of the Thomas property attracted the attention of Mr. A. L. Fisher, 702 Hobart Bldg., San Francisco. After going over the property carefully Mr. Fisher was so impressed with the showing that arrangement was made for its immediate development.

Work was started in February, 1923. Camp Carbon with accommodations for 15 to 20 men was established near the point where the old tunnel had been run, mining and hoisting equipment were brought in, and 7 to 9 men put to work.

The first work consisted in clearing away the debris in the vicinity of the old tunnel and making an open cut so as to clearly define the vein. Although the coal was broken and shattered near the surface, the face of the cut exposed a vein from 12 to 14 feet in thickness, apparently dipping east about 20 degrees.



Photo No. 3. Surface Works and Incline. Camp Carbon Coal Mine, Mendocino County, Cal.

The main entry, 8 feet wide at the bottom, 7 feet at the top and 6 feet high was started here and run east following the dip of the coal. When in about 40 feet it was found that the slope of the incline was too great as it ran into the yellow clay floor underlying the coal. From this point on the grade was gradually flattened to about 10 degrees which is nearer the average dip of the coal so far developed.

At the time of visit on May 1, 1923, the entry was in 95 feet, at which point it was again practically in the center of the vein, there being about 3 feet of coal underneath the car tracks and 3 feet above the top lagging. So far as could be seen there was no parting of shale or other impurities in the coal and no visible pyrite.

The surface drainage in the vicinity of the main entry is toward the north. As the incline runs east it passes under the flow from several springs farther up the hill to the south. Owing to local surface depressions the face of the entry was only a short distance vertically below

the surface and progress was slow on account of the wet ground; heavy timbering and close lagging being required to hold it.

On June 1st the incline had been advanced to 135 feet,¹ and the face of the entry was just beyond the point where the last and largest surface watercourse crosses. For some distance, when under this watercourse, the coal vein was pinched down and averaged only about $4\frac{1}{2}$ feet in thickness, but it began to widen up again after this point was passed. Beyond this watercourse the surface rises more steeply toward the east, and as the entry is advanced the vertical depth will increase much more rapidly.

It is expected that the coal will then become firmer than it was where covered only with a thin, water-soaked and more or less disintegrated shale and sandstone roof. Even in this area portions of the vein are quite solid and if desired chunks of coal a foot in diameter could be obtained by careful mining. Efforts have been confined, however, to advancing the entry as fast as possible and the coal is churn drilled and shot without regard to the condition in which it is recovered.

On June 15th the working force was increased to fourteen men and the mine was being operated two shifts per day. The Camp Carbon coal is of uniform black color. The more solid portions break with a conchoidal fracture, resembling in this respect Cannel coal. It burns with a long flame, produces little ash, and is used at the mine for domestic purposes and operation of the steam hoist with very satisfactory results.

The following is an analysis made by an independent assayer on a sample taken soon after the entry was started:

"Volatile combined matter-----	54.2	per cent
Fixed carbon -----	43.8	per cent
Ash -----	2.0	per cent
Coke -----	45.8	per cent
Ash in coke-----	4.56	per cent
B.t.u. (coal) -----	13,991	

"This coal is classified as sub-bituminous, the percentage of fixed carbon indicating a semi-coking coal of exceptional low ash content. The percentage of fixed carbon is not high but the fuel value is, and it should be excellent for household and industrial purposes."

That portion of the Coast Range containing the Camp Carbon Coal Mine and other Eel River deposits is not included in the areas mapped by the U. S. Geological Survey, and there are no maps available showing in any detail either the areal geology or the topography of this region.

The ground rises at a fairly uniform slope from Eel River to the Camp Carbon property and continues to rise to the south and east from the present mine workings. In the vicinity of the river there is evidence of much faulting and intrusions of metamorphic rocks. Farther south in the vicinity of the Camp Carbon Mine the formations are less disturbed and there is a possibility that the coal may be practically continuous over a large portion of the Camp Carbon Mine acreage.

Until a more detailed study is made it is impossible to definitely correlate this vein with the one exposed in the river. Mr. Fisher believes that the Camp Carbon coal differs from the former in some respects and that it is an entirely distinct vein.

Neither has the age of the Camp Carbon coal been determined. Some fossils were gathered from the overlying sandstone but they were too

¹Since the above was written the entry has been advanced approximately 500 feet. Thickness of vein at face about 12 feet.

imperfect and too few to form a suitable marker for determination. The formations adjacent to the coal, near the river, have been classified as Cretaceous, and there is reason to believe that the Eel River coal measures are of Cretaceous age, in contrast to most of the coal in the state which is generally assigned to the Tertiary (Eocene) Period. Except for a small area of Tertiary rocks near Point Arena, a strip of Cretaceous formations along the coast and small areas of Quarternary deposits along the Russian River, and near Laytonville and Round Valley, the whole of Mendocino County including the Eel River section is shown on the Geological Map of California¹ as Franciscan.

The Camp Carbon Mine has an elevation of approximately 1800 feet and the workings are estimated to be from 700 to 900 feet above the outcrop in Eel River. It is 6 miles southeast of Dos Rios, the nearest railroad point, and $2\frac{1}{2}$ miles by road from the river. There is a good water supply from several springs and fair timber on the property. Climatic conditions are favorable and mining can be carried on the year round without difficulty.

The development to date at the Camp Carbon Coal Mine, upon observation, presents two impressive features: first, that coal of such quantity and quality as the small amount of work already done has shown to undoubtedly exist on the property, could lie undeveloped for so many years; and, secondly, the substantial and (coal) miner-like manner in which it is being opened up and equipped for production.

With the main entry 8' x 7' x 6' high, going in directly on the dip of the vein every foot advance represents a certain tonnage of coal and exploitation is rendered easy and efficient.

Since the completion of the Northwestern Pacific Railroad from San Francisco to Eureka the main transportation problem in this field has been solved. Connection between the railroad and the Camp Carbon Mine can be made readily with a spur track or aerial tramway with downhill trip for the load.

The exceptional quality of the Eel River coal attested by analyses and practical use at the mine; the added possibility that this coal may have valuable coking qualities and the large tonnage that is being shown to exist, marks the opening up of the Camp Carbon Coal Mine as one of the important recent developments in mining in this state.

Camp Carbon Coal Mine is under purchase contract to *Carbon Company*, 312 Henshaw Bldg., Oakland California. A. N. Massey, an experienced coal-mine superintendent, is in charge of operations at the mine.

LOS ANGELES FIELD DIVISION.

W. B. TUCKER, Mining Engineer.

Imperial County.

The California Gypsum Corporation. This company owns extensive deposits of gypsum, located in the Fish Creek Mountains, in Sec. 29, T. 13 S., R. 9 E., S. B. M., about 45 miles northeast of El Centro, in the western part of Imperial County, near the San Diego line.

Active development of these deposits was started early in 1922, and, since the last report made on the property, a crushing and refining plant of 400 tons capacity has been built at the new station at Dun-

¹Geological map of the State of California, California State Mining Bureau, 1916.

away, on the San Diego and Eastern Railroad, a few miles west of Dixieland. A narrow gauge railroad has been built from this point to the mine, a distance of twenty-six miles.

The company is shipping from 200 to 300 tons a day to the Blue Diamond Materials Company, at Los Angeles.

Samuel W. Dunaway is managing director of the company.

Bibliography: State Mineralogist Reports XVIII, p. 421; XIX, p. 31.

Kern County.

Poso Mine comprises 13 claims, located in the Pine Mountains district, in Secs. 30 and 31, T. 27 S., R. 20 E., 22 miles northeast of Bakersfield, on Poso Creek. Elevation 1800 feet.

It was discovered in 1915 by W. H. Fritz, and acquired in 1922 by the Poso Mining and Milling Company of Bakersfield. E. W. McCutchen, president; J. A. Lewis, secretary.

Three parallel veins occur in the granite, striking N. 45° W. and dipping 65° S.W., width 2 to 4 feet. The ore is free milling gold quartz with some hematite and pyrite. It also carries values in silver.

Development consists of a shaft sunk on one vein to a depth of 120 feet on an incline of 70 degrees. From Poso Creek a tunnel is driven on this vein 365 feet to the northwest, connecting with the shaft at a depth of 120 feet. The vein developed in this tunnel shows from 18 inches to 4 feet of oxidized quartz, mineralized with hematite and some iron pyrite. An ore shoot was developed 210 feet from the portal of the tunnel, which was said to average from \$10 to \$12 in gold, with some silver values. Length of pay shoot is 150 feet, with average width of 2 feet. Twenty feet southeast of the shaft the vein is cut by a N. 75° E. fault, dipping 40° S.E., which also cuts off the ore.

This ore shoot has been stoped at intervals above the tunnel level for 50 feet.

Mine equipment: 16-horsepower gas engine hoist, compressor and air drills.

Mill: Blake crusher, 8" x 10"; 5-foot Huntington mill, Wilfley concentrator driven by 37½-horsepower Fairbanks-Morse type Y, semi-Diesel vertical engine.

Five men are employed.

The Tropico Mines, located 5 miles northwest of Rosamond, in Secs. 10, 11, 14 and 15, T. 9 N., R. 13 W., is reported to have been taken over under lease and bond by J. F. White, of Los Angeles. The workings consist of a shaft 300 feet deep, and 2000 feet of drifts.

During the year 1922, the property has been under lease to H. Clifford Burton, of Rosamond.

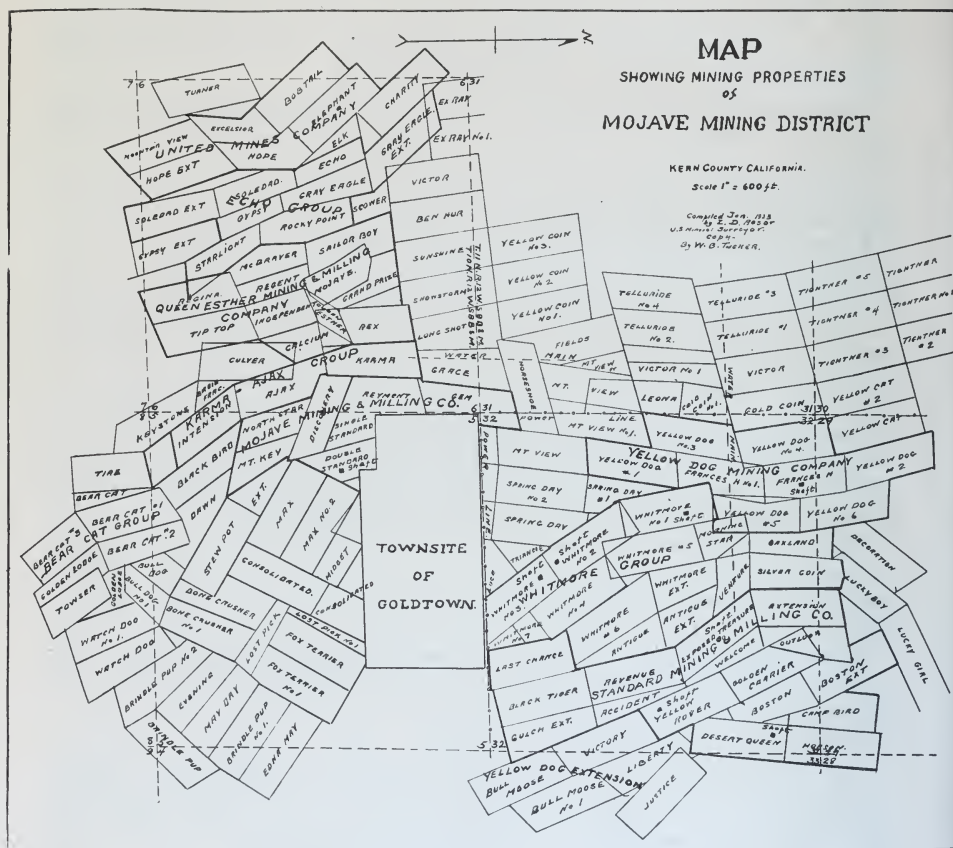
It is stated that a contract has been let to sink the shaft to the 700-foot level. Owners: Tropico Mining and Milling Co., Rosamond, Cal.

Bibliography: State Mineralogist's Report XIV, p. 512.

AMALIE MINING DISTRICT.

Zenda Mine is situated 12 miles northeast of Caliente, in Sec. 30, T. 30 S., R. 33 E. Owner, Zenda Gold Mining Company of New York; Arthur D. Storke, general manager. Since the XVII Report of the State Mineralogist was published, a 200-ton cyanide plant has been completed, which is now under operation. The company also recently completed a three-mile power line connecting with the main power line of the Southern California Edison Company.

Bibliography: State Mineralogist's Report XIV, p. 515.



MOJAVE MINING DISTRICT.

The Mojave Mining District is situated in a group of small hills, centering around Soledad Butte. These are located 4 miles southwest of Mojave, the junction point of the Santa Fe and Southern Pacific railroads, and include the territory in T. 10 and 11 N., R. 11, 12 and 13 W., S. B. M. (See claim map.)

Topography: The topography presents low ranges of hills and isolated peaks of igneous or volcanic origin, which rise not more than 1500 to 2000 feet above the level of the desert; the valleys, which are

of much greater area than the hills, are typical waste-filled interior basins characteristic of the desert. Soledad Peak is about 4000 feet above sea level, and about 1250 feet above the general level of the desert. A number of smaller hills are grouped south of Soledad Mountain. Bowers Hill or Exposed Treasure Butte is about one-quarter of a mile northeast of Soledad Butte and has an elevation of 400 feet above the desert.

Geology: Granite underlies the entire district. There is an exposure on the surface along the northeast flank of Bowers Hill, which extends to the southwest. Rhyolite porphyry lies upon and in contact with the granite, and has by far the greatest exposure of all rocks of the district. Rhyolite occurring in sheets and patches overlies the rhyolite porphyry and forms the summits of several buttes.

The principal veins are on the northern flank of Soledad Mountain, on Bowers Hill, and to the west of Bowers Hill on the desert plain.

The veins that have been worked to any extent on the northern flank of Soledad Butte, occur in the rhyolite-porphyry, and are more or less parallel, their strike being from north to N. 30° W., and dip from 80 degrees to 60 degrees east for a certain depth, where they flatten rather abruptly. The maximum width of the veins is about 12 feet and the minimum width 3 feet. Beginning at the west, the principal and largest veins are the Elephant, Hope, Echo, Gray Eagle, and about one-half mile further east, Queen Esther, Karma and Double Standard veins. All these veins are typical quartz veins, containing quartz and minerals derived from the alteration of the wall rock and deposited in the fissures. The pay ore is more or less irregularly distributed, but it occurs in well defined shoots or lenses, having widths of from 4 to 15 feet, varying in size up to 200 feet along the veins. The gold occurs free, associated with pyrite. The silver occurs as horn silver (cerargyrite), changing to argentite in depth.

On Bowers Hill, there is a series of parallel veins, which have a general north and south strike for a distance, then splitting into numerous branches in a northwesterly direction. These veins dip 60 degrees east for some distance, then flatten rather abruptly to inclinations varying between 30 degrees and 45 degrees, growing flatter with depth, as shown in the lower workings of the Exposed Treasure Mine. Here on the 900-foot level the dip of the vein is only 25 degrees. The wall rock of these veins for a distance is rhyolite-porphyry, and then the veins follow the contact between the granite and rhyolite-porphyry. The vein filling of these lodes is quartz, granite, and calcite, with soft blackish-brown mixture of ferruginous clay and manganese dioxide. The pay ore from 4 to 15 feet in width lies in well defined shoots or lenses, varying in length up to 300 feet. The gold occurs free, associated with pyrite, chalcopyrite, with smaller amounts of galena, marcasite and sphalerite. The silver occurs as horn silver (cerargyrite) and argentite.

The Whitmore and Yellow Dog vein systems are to the west of Bowers Hill on the desert plain. The veins are more or less parallel and strike north to N. 30° W., dipping 45° to 60° E. Widths vary from 3 to 12 feet. These veins occur on the contact of granite and rhyolite-porphyry. The vein filling is similar in character to the Exposed

Treasure vein, consisting of quartz, with massive calcite, and brownish-black ferruginous clay and manganese dioxide.

The approximate production of the district has been over \$3,000,000.*

MINES.

Double Standard, owned by *Mojave Mining and Milling Company*, 261 I. W. Hellman Building, Los Angeles; G. E. Benton, president; A. H. Wollacott, secretary; E. B. Wagemann, superintendent. Consists of 40 acres in Sec. 5, T. 10 N., R. 12 W., S. B. M., 3 miles south of Mojave. Elevation 2700 feet.

The vein occurs in rhyolite-porphyry. It strikes northeast, dips 40° W. and has a width of 3 to 5 feet. The major values are in silver. Workings consist of a shaft 200 feet deep, with levels at 100 and 200 feet. On 100-foot level, a drift 650 feet; on 200-foot level, a drift 850 feet.

Mine equipment consists of hoist, cars, tools, and dwellings. Reduction equipment consists of 5-stamp mill.

In 1919, 55,100 pounds of ore were shipped to the smelter; assay value, gold .87 ozs., silver, 13.30 ozs. Idle.

Echo Group of Mines (Gray Eagle), consists of the following claims: Soledad, Soledad Extension, Echo, Gypsy, Gray Eagle, Gray Eagle Extension, Starlight and Rocky Point, totaling 100 acres, patented, in Sec. 6, T. 10 N., R. 12 W., S. B. M., 4 miles south of Mojave, at an elevation of 3500 feet.

There are three parallel veins on the property, known as the Echo, Starlight and Gray Eagle, which occur in rhyolite-porphyry. The general course of these veins is northwest, and they dip to the northeast. The outcrop of the Echo vein can be traced on the surface for 1800 feet, and throughout its entire length it has a width of 4 feet. The wall rock is silicified rhyolite-porphyry. The gold occurs free, associated with pyrite. The silver occurs as hornsilver (cerargyrite), changing to argentite in depth. The ore shoots in the vein occur in irregular lenses, which have a length of from 100 to 200 feet. The Starlight vein is about 300 feet east of the Echo vein, is parallel to its strike and dips to the northeast. Average width is 3 feet. It is reported that this vein carried a high silver content.

The Gray Eagle vein commences near the northern end of the Starlight vein, diverging from it in a southerly direction, but finally runs parallel to it. The dip is almost vertical and average width about 3 feet. Underground workings: At an elevation of 3200 feet, No. 1 Echo tunnel is driven N. 25° W. 240 feet to the vein, with drifts northwest and southeast on the vein for approximately 500 feet. At an elevation of 3400 feet, No. 2 Echo tunnel is driven southwest on Echo vein for a distance of approximately 500 feet. The ore is stoped to the surface for a length of 240 feet. The vein in these workings shows a width of 4 to 7 feet, the vein material consisting of quartz and silicified rhyolite, stained with iron oxide. At an elevation of 3450 feet, the Gray Eagle tunnel is driven southeast about 450 feet on the Starlight vein,

*Have made use of Chas. E. W. Bateson's report on the Mojave Mining District, in Trans. A. I. M. E., Vol. 37, pp. 160-177, especially in regard vein systems on properties that are idle and workings caved.

then crosscut 40 feet northeast to the Gray Eagle vein, which is drifted on approximately 400 feet, and from this level a shaft has been sunk to a depth of 350 feet, with levels at 100, 200 and 300 feet. On 100-foot level, drifts on vein 510 feet; on 200-foot level, 650 feet; on 300-foot level, 1040 feet. It is reported that a pay shoot 240 feet long was developed on the Gray Eagle vein, the width being from 4 to 15 feet. These veins have been stoped to the surface above the tunnel levels, and also stoped to a depth of 300 feet on the ore shoot. The property was formerly operated by the Echo Consolidated Mining Company, the ore being treated in a 10-stamp mill, which plant was dismantled in 1906. Reported to have a production record of \$200,000. Owners, A. Asher and Bert Fisher of Mojave.

Elephant Group of Mines consists of the following claims: Mountain View, Excelsior, Elephant, Hope, Extension, Elk and Charity, approximately 100 acres, located in Sec. 6, T. 10 N., R. 12 W., about 5 miles south of Mojave, at an elevation of 3000 feet.

Owned by *United Mines Company*; Ward Perry, president; H. F. Benecke, vice president; Mr. McClellan, secretary, Chicago, Ill. Under lease to H. F. Benecke, H. F. Hickman, and M. L. Oliver of 160 Santa Fe Ave., Los Angeles.

Three roughly parallel veins, known as the Hope, Excelsior, and Elephant, have been developed on the property. They have a general northwest strike, with dips varying from 50 degrees to 80 degrees to the northeast. These veins occur in silicified rhyolite-porphyry. The vein material is highly brecciated, containing quartz and included silicified porphyry, which is stained with iron oxide. The veins vary in width from 3 to 7 feet. Workings on the Elephant vein consist of a shaft 120 feet deep, sunk on incline of 75 degrees, with levels at 50 and 100 feet. On 50-foot level, drift southeast 60 feet. On 100-foot level, drift southeast 350 feet, and drift to northwest 210 feet. On the 100-foot level, in drift to southwest, the vein has been stoped to the surface for a distance of 120 feet. It is reported that ore from these workings had a value of \$25 to \$200 per ton.

The development at present is confined to the Excelsior vein, on the northwest slope of Soledad Mountains, at a distance of 1800 feet west of the Elephant shaft. The ore is trammed from Excelsior tunnel to the mill below Elephant shaft. The Excelsior vein is developed by a crosscut tunnel driven N. 30° E. 100 feet. At 20 feet from the portal it cut the vein which is drifted on northwest 100 feet.

North of these workings, a number of shafts have been sunk on the vein to depths of 50 to 100 feet. The vein is 3 feet wide. About 200 feet southeast of Excelsior tunnel, the Hope vein is developed by two tunnels, the lower tunnel is driven on the vein to the north 400 feet. At 160 feet from the portal it cut an ore shoot about 100 feet in length, which has been stoped to the surface. The vein has an average width of 3 feet. Mine equipment consists of 25-horsepower electric hoist and Rix compressor. Mill consists of 25-ton Herman ball mill, driven by 25-horsepower motor, and amalgamating plates. Ore being milled comes from the Excelsior tunnel. Three men are employed. M. L. Oliver, superintendent.

Exposed Treasure and Desert Queen Mines, the largest producer in the district, consists of the following claims: Last Chance, Black Tiger, Revenue, Exposed Treasure, Extension, Gulch Extension, Accident Gulch, Wedge, Outlook, Yellow Rover, Golden Carrier, Boston, Boston Extension, Desert Queen, Hobson and Camp Bird, located in Sec. 32, T. 11 N., R. 12 W., about $3\frac{1}{2}$ miles south of Mojave on Bowers Hill. Holdings comprise 280 acres of patented ground, and 60 acres held by location, owned by the *Standard Mining and Milling Company*, Grosse Building, Los Angeles; W. E. Goodyear, president; James Westerfeldt, secretary; W. H. Thorpe, general manager. The property was acquired in 1921 by the present owners from the *Mojave Consolidated Gold Mines Company*, who operated the property until 1915. Seven parallel veins have been developed on the property known as the Mill, Assay Office, Golden Carrier, Yellow Rover, Boston, Exposed Treasure, and Desert Queen. The most productive have been the Exposed Treasure, Desert Queen and Yellow Rover veins. The most extensive development work has been confined to the Exposed Treasure and Desert Queen veins. These veins have a general north and south strike, but split into numerous branches which strike N. 30° W. The veins near the surface have a dip of 60 degrees for a certain distance, then flatten to inclinations varying from 30 degrees and 35 degrees, growing flatter with depth, as the Exposed Treasure vein on the 900-foot level has a dip of only 25 degrees to the northeast. The veins have widths varying from 4 to 15 feet. Workings consist of shafts on the different veins. On the Exposed Treasure vein an incline shaft has been sunk to a depth of 900 feet with levels at intervals of 100 feet, with over 10,000 feet of drifts and stopes. The Exposed Treasure shoots of ore trend to the north. The vein has been stoped from the 600-foot level to the surface, the pay shoots being from 100 to 600 feet in length, with widths varying from 4 to 15 feet. On the 900-foot level, a shoot of ore has been developed, 7 feet wide, which shows some very high grade ore, carrying free gold. There is a probability of developing a considerable tonnage of ore from the 900-foot level to the 600-foot level, that will average about \$10 to \$12 per ton.

On the Yellow Rover vein an incline shaft has been sunk to a depth of 340 feet, with levels at 100, 200, and 300 feet.

This vein is from 4 to 15 feet wide, and is said to have produced some high grade ore.

On the Desert Queen vein, a shaft has been sunk to a depth of 400 feet on a 70 degree incline, with levels at 100, 200, 300 and 380 feet. At the 100-foot level, the vein flattened; on the 200-foot level, it was cut 20 feet east of the shaft; on the 300-foot level, 100 feet east of the shaft; on the 400-foot level, 180 feet east of the shaft. The vein has an average width of 3 feet, with granite footwall and rhyolite-porphry hanging wall. The present development work has been confined to the Desert Queen shaft, where electric pumps were installed, and the mine unwatered. At a depth of 380 feet in the Desert Queen shaft, a crosscut has been driven west 800 feet, cutting the Boston vein at 100 feet, Yellow Rover vein at 510 feet, Golden Carrier vein at 590 feet, Assay Office at 630 feet and Mill vein at 800 feet from the shaft. It is expected that the Exposed Treasure vein will be crosscut between 800

and 900 feet, at a depth of 135 feet below the 900-foot level of Exposed Treasure Mine. The present crosscut has drained the Exposed Treasure workings, and when the Exposed Treasure vein is cut, it is proposed to raise on the vein connecting with the 900-foot level north of the shaft. The Mojave Consolidated Mines Company was compelled to suspend operations on the property in 1915, due to the large amount of water encountered on the lower levels of the Exposed Treasure Mine, as with the steam equipment then on the property, they could not handle the water.

The installation of an electric power line, which crosses the district, by the Southern California Edison Company, has enabled the present company to install electric pumps which will enable them to handle the water, and develop the ore shoot discovered on the 900-foot level.

Mine equipment consists of 30-horsepower electric hoist (10 $\frac{1}{4}$ " x 10"), Ingersoll Rand compressor (16 $\frac{1}{4}$ " x 10"), air drills, five Byron-Jackson pumps driven by electric motors, machine shops, assay office and dwellings. Reduction equipment consists of two Blake crushers, 60-ton cyanide plant (nine sand vats, and three slime agitators). The original 20-stamp mill has been dismantled and sold. Water is secured from the Tehachapi Mountains, a distance of 18 miles, through the Soledad pipe line, which is owned by the company. It is stated that in previous operations the ore milled averaged \$12 to \$15 per ton, but the recovery was low.

Fifteen men are employed. Production record to date is about \$2,000,000.

Bibliography: Transactions Am. Inst. Min. Engineers, Vol. XXXVIII, pp. 310-319; Report XIV, State Mineralogist, pp. 504-505.

Karma Mine, owned by E. L. Wegmann of Mojave, comprises the following claims: Karma, Ajax, Intension, Junction, totaling 70 acres, located in Sec. 6, T. 10 N., R. 12 W., about 4 miles south of Mojave, at an elevation of 3200 feet. Two parallel veins have been developed on the property. The outcrops can be traced on the surface for a distance of 1000 feet. They vary in width from 4 to 15 feet. The general course of the veins is north, dip 60 degrees east, with silicified rhyolite-porphry walls. The vein is sugary quartz, stained with iron oxide. It is reported the pay-shoot was 240 feet in length, and 15 feet wide. A high grade streak of ore occurs along the hanging wall. The gold is free with a small percentage of pyrite. Workings consist of a tunnel 1800 feet long on the vein, shaft 160 feet deep, drifts and stopes.

Mine equipment consists of cars, assay office, shops and dwellings. Reduction equipment: Old 20-stamp mill, 850-lb. stamps.

Water is secured from the Soledad pipe line, owned by the Standard Mining and Milling Company.

Property was worked by Karma Mining Company, from 1898 to 1904. Purchased by E. L. Wegmann, in 1918. Since that date, the property has been under development, and it is reported a large tonnage of ore has been developed. Idle.

Bibliography: Report XIV, State Mineralogist, p. 499.

Queen Esther Mine is one of the large producers of the district, which was operated from 1894 to August, 1910, when operations were suspended. The property has been idle since that date. The production in gold is reported to have been about \$200,000.

Holdings consist of the following claims: Regina, Mojave Bonanza, Tip Top, Independent, Calcium, Queen Esther, Rex, Regent, McBrayer, Sailor Boy, totaling 160 acres, located in Sec. 6, T. 10 N., R. 12 W., 4 miles south of Mojave, at an elevation of 3200 feet.

Owners, *Queen Esther Mining and Milling Company*, Pacific Mutual Building, Los Angeles. Seeley W. Mudd, president; A. A. Barnard, secretary.

The Queen Esther vein runs nearly north and south. It dips 40 degrees to the east. The vein has a width of 4 to 8 feet, and at places attains a maximum width of 12 feet. The vein rolls or folds as it gains in depth. These folds dip along the vein about 10 degrees to the north. The vein is filled with brownish colored quartz. The country rock is silicified rhyolite-porphyry. Underground workings consist of several tunnels on the vein, 500 feet in length, with several thousand feet of drifts. Some of the ore contained considerable silver. The pay-shoot worked is reported to have been 500 feet in length, with an average width of 8 feet. Mill was dismantled in 1918.

Bibliography: Report XIV, State Mineralogist, p. 508.

Gold Coin Group, consists of the following claims: Gold Coin, Gold Coin No. 1, and Victor No. 1, located in Secs. 31 and 32, T. 11 N., R. 12 W., 3 miles south of Mojave. Owners, *New Tonopah Dividend Mining Company*, Tonopah, Nevada. J. R. Cunningham, president; E. P. Cullinan, secretary and manager.

The property is located west of the Yellow Dog Mine on the flat, at an elevation of 2700 feet. The company is sinking a prospect shaft in granite wash with the hope of developing a parallel vein to the Yellow Dog vein. The present depth of the shaft is 180 feet, and it is still in granite wash.

Four men are employed.

Whitmore Mine consists of 10 claims known as: Whitmore No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, No. 7, Whitmore Extension, Antique, Antique Extension, and Valley, approximately 160 acres, located in Sec. 32, T. 11 N., R. 12 W., at an elevation of 2700 feet, $3\frac{1}{2}$ miles south of Mojave. This group of claims lie between the Exposed Treasure and Yellow Dog mines.

Owners, W. K. Whitmore and J. E. Whitmore of Mojave. The principal development work has been confined to Whitmore No. 1, No. 2, No. 3, and No. 7 claims.

The property was operated in 1912 by the *St. Mary Mining Company* of Arizona. It was later acquired by the present owners.

Four parallel veins occur along a series of roughly parallel rhyolite-porphyry flow dikes. The general course of these porphyry dikes is N. 30° W. and dips 60 degrees east. The veins strike north, to N. 30° W. and dip 60 degrees east. Their widths vary from 2 to 6 feet. On Whitmore No. 1 claim, a shaft has been sunk on the most westernly vein to a depth of 300 feet, on an incline of 75 degrees, with levels at

100 and 200 feet. On the 100-foot level, the vein has been drifted on north 165 feet, and south 60 feet. On the 200-foot level, north 160 feet, and south 120 feet. This shaft was sunk on the vein for a distance of 225 feet, then vertical for 75 feet, in the footwall. At the 270-foot depth a crosscut was run 70 feet east to the vein. The vein has rhyolite-porphry footwall and granite hanging wall. The vein developed on these two levels has an average width of 3 feet, and is reported to carry values in gold and silver of from \$6 to \$50 per ton. Whitmore No. 3 shaft is 400 feet southeast of No. 2 shaft and is an incline shaft 100 feet deep. The vein developed is from 2 to 4 feet in width, and reported to have a value of \$20 per ton in gold. The ore is free milling, containing some pyrite.

Equipment consists of 6-horsepower Fairbanks-Morse gas engine hoist, compressor, 10" x 10", driven by 32-horsepower Fairbanks gas engine, shops and dwellings. Two men are employed on development work.

Yellow Dog Mine consists of the following claims: Yellow Dog No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, Francis H. and Francis H. No. 1, totaling approximately 160 acres, located in Secs. 29, 32, T. 11 N., R. 12 W., 3 miles south of Mojave. Owners, Yellow Dog Mining Company. L. L. Patrick, president; Walter B. Kibby, secretary; Sol Camp, superintendent. Offices, 803 H. W. Hellman Building, Los Angeles.

During the early part of 1922, Mr. Percy Wegmann of Mojave discovered an outcrop of quartz carrying free gold on this group of claims. The above-mentioned claims were located by P. Wegmann, J. Withers, and Bert Fisher of Mojave, and were afterwards acquired by the present company. This discovery of high grade gold ore is the most important made in the district in recent years, and has caused a revival of interest in the opening and development of other properties in the district. The vein strikes north and dips about 60 degrees to the east. Has an average width of 10 feet, and a maximum width of 15 feet. The high grade gold quartz occurs on the hanging wall, with a vein of spar from 6 to 8 feet wide heavily stained with manganese on the footwall. The vein occurs on the eastern slope of a small butte of rhyolite-porphry, and has a rhyolite-porphry footwall with granite hanging wall. It is reported that samples taken from the spar vein will average \$3 per ton, while the average value of samples from 4 feet of vein quartz was better than \$25 per ton in gold.

Developments: At an elevation of 2800 feet, a shaft has been sunk on an incline of 60 degrees to a depth of 275 feet, with levels at 100 and 200 feet. On the 100-foot level, the vein has been drifted on 272 feet north and 100 feet south. On this level, an ore shoot was cut 150 feet north of the shaft, which is developed for a distance of 120 feet, the vein having an average width of 12 feet. It is said to average \$25 per ton. On the 200-foot level there is a drift north 150 feet, and south 200 feet. Besides this shaft, a number of shallow shafts have been sunk to depths of 60 feet along the vein, both north and south of the main shaft. South of the shaft the vein is faulted about 20 feet to the west by a fault which strikes N. 60° W.

Equipment consists of 15-horsepower electric hoist, Chicago pneumatic compressor (10" x 12") driven by 50-horsepower motor. Water

is secured from the Soledad pipe line, owned by the Standard Mining and Milling Company. Electric power is secured from the Southern California Edison Company. Eight men are employed.

Yellow Dog Extension Mine comprises five claims, known as: Liberty, Victory, Bull Moose, Bull Moose No. 1 and No. 2, Bull Moose Fraction, totaling 100 acres, located in Sec. 33, T. 11 N., R. 12 W., 3 miles south of Mojave. Elevation 2800 feet. Owners, Yellow Dog Extension Mining Company, 308 H. W. Hellman Building, Los Angeles. E. M. Brown, president; Luther Emery, secretary; C. L. Putnam, manager.

The company also has under lease from the Standard Mining Company a section of ground 600 feet by 447 feet. The property is located on the east slope of Bowers Hill, to the east of the Standard Mining and Milling Company property.

Two parallel veins have been developed on the property, the most prominent being the Russian Boy vein. These veins strike N. 30° W., and dip 45 degrees east. The company is sinking a 2-compartment vertical shaft to a depth of 200 feet, also driving a cross-cut on the 100-foot level to develop the Russian Boy vein. This vein is expected to be cut by the shaft at a vertical depth of 200 feet. At an elevation of 2850 feet, a tunnel has been driven on the Russian Boy vein N. 35° W., 150 feet. The vein has a width of 6 feet. A shoot of ore was developed about 75 feet in length, with an average width of 6 feet, which has been stoped to the surface throughout its length. The country rock is granite and rhyolite-porphyry. The vein filling is quartz and calcite stained with manganese and iron oxide. Quartz shows free gold associated with pyrite.

Equipment: 7-horsepower gas engine hoist, truck, shops and buildings. Five men are employed.

Los Angeles County.

Chicago-Pacific Clay Deposit. This deposit is located in the range of hills north and south of Soledad Canyon, in Secs. 8, 9, 15, 16, and 17, T. 4 N., R. 14 W., M. D. M., 11 miles east of Saugus, and one-quarter of a mile north of Lang Station, on the Southern Pacific Railroad.

Holdings consist of 13 claims, 7 in the Pacific group and 6 in the Chicago group.

It is a massive deposit of white metamorphic granite (quartz-feldspar rock) containing high aluminum content, which, according to the analysis, should probably be satisfactory for the manufacture of fire brick and certain kinds of pottery. The low iron content of the rock suggests its use for high grade Portland cement, and it also might be used as a paint filler.

The general strike of the formation is east, and it can be followed from Lang to Alpine Siding on the Southern Pacific Railroad, a distance of two miles. It is about two miles in width and occurs on a contact with schist, which lies to the south of the granitic rock.

The following is an analysis of the material made by the C. W. Hill Company of Los Angeles:

Moisture -----	0.10%
Loss in ignition-----	0.55%
Silica -----	58.10%
Alumina -----	28.27%
Ferrie oxide -----	1.03%
Lime -----	8.60%
Magnesia -----	0.54%
Potash -----	1.60%
Soda -----	0.82%
Total -----	99.61%

Owners, J. P. Monahan and J. G. Kronn, 322 Homer Laughlin Building, Los Angeles.

Ramelli Dolomite Deposit. The deposit is located on the west slope of the San Gabriel Mountains, in Sec. 17, T. 3 N., R. 15 W., M. D. M., 4 miles northeast of San Fernando. Elevation 2200 feet. Holdings consist of two claims, 40 acres.

A stratum of white crystalline dolomite occurs in the granite, with a general easterly and westerly course, and dip 45 degrees to the north. The exposure is from 200 to 500 feet in width and it can be traced for the full length of the two claims.

Owners, Frank Ramelli and Edward Oviatt of Van Nuys.

Orange County.

Silverado Mine. It is situated in Silverado Canyon, 20 miles east of Santa Ana. The property was formerly owned by the *Blue Light Mining Company* of Los Angeles, and has been recently acquired by a group of Orange County men, with Stanley Chapman of Fullerton as the largest stockholder.

The officers of the new company are as follows: Charles Eygabroad, president; Stanley Chapman, vice president; Sam Collins, secretary, and O. H. Pember, superintendent.

The present company plans to enlarge the 50-ton flotation plant. Thirty men are employed on development work.

The ore is silver-bearing galena, associated with zinc-blende and pyrite, and the vein is from 2 to 4 feet wide.

Bibliography: State Mineralogist's Report XVII, p. 323.

San Bernardino County.

RANDBURG DISTRICT.

The silver-bearing region of this district continues quite active, although a number of the smaller companies have suspended operations, due to the completion of the Pittman Act and the present price of 62 cents for silver. There are still a number of companies vigorously prosecuting development work on their holdings.

There has been a noticeable revival of interest in the gold mines of the district, and active development work has been started on a number

of properties that have long lain dormant; the outstanding features being the discovery of high grade gold ore on the Silver Basin group, and the development of a new shoot of ore on the Black Hawk, west of the Blue fault, on the 100-foot level of the Black Hawk Mine. The shoot is 65 feet long, with an average width of 3 feet. It is reported to have an average value of \$50 per ton in gold. The find is important as it opens up new territory on the property, as nearly all previous production came from east of the Blue fault.

MINES.

Big Gold Mine consists of the following claims: North Star, Lucky Strike, Neglected, Kenneth B. Fraction, totaling 74 acres, located in Secs. 3 and 4, T. 30 S., R. 40 E., 3 miles southwest of Randsburg. Elevation 3800 to 4000 feet. Owner, E. Spillane of Randsburg, under option to Big Gold Mines, Inc. W. Roland, president; Guy Jones, secretary; S. L. Pearce, manager. The property is located on the northwest slope of the Rand Mountains, and adjoins the Minehaha Mine on the west.

The country rock is granite and schist. A series of parallel north and south quartz veins occur in the schist, and there is also an east and west system of veins that intersect the north and south veins.

The principal development work has been confined to the Big Gold vein, which occurs on a fault fracture, on the contact of granite and schist. This vein has a course of N. 20° W. and dip of 40 degrees east. Its average width is 4 feet. The quartz carries free gold, and a small percentage of pyrite. The croppings of the vein are prominent and can be traced for a distance of 3000 feet.

Mine workings consist of a 2-compartment vertical shaft 385 feet deep. The shaft intersected the vein on the 155-foot level, and the vein has been drifted on 200 feet south, and 30 feet north on this level. Above the 155-foot level the vein has a granite hanging wall and schist footwall, and below this level the hanging wall is rhyolite-porphyry, with schist on the footwall. A rhyolite-porphyry dike 25 to 50 feet in width was cut in the shaft on the 155-foot level, which strikes N. 20° W. and dips 40 degrees east, forming one wall of the vein. A winze has been sunk on the vein from the 155-foot level to a depth of 105 feet. South of the shaft, the different veins have been developed by a number of tunnels from 50 to 100 feet in length.

Mine equipment: Consists of 6-horsepower Fairbanks-Morse gas engine hoist, 2-drill compressor, air drills, and blacksmith shop. Six men are employed.

Black Hawk Mine (gold and silver) consists of the following claims: Lassen, Shasta, One-Track, Gray Eagle, Two-Track, O. K. No. 1 and No. 2, Black Hawk and Wedge, totaling 130 acres. Property was discovered in 1896, and operated by D. A. B. Blue until 1921, when it was purchased by the *Pittsburg Mount Shasta Mining and Milling Company*, J. J. Schneider, president; T. V. Scott, secretary, and D. F. McCormick, manager. J. O. Grenan is superintendent. Offices, 516 Federal Building, Pittsburg, Pennsylvania.

The present company started operations February 21, 1923, and the property has been under continuous development to date.

The 5-stamp mill on the Black Hawk Mine has been remodeled, and has been operating continuously on ore from the mine. On the Shasta Claim, at an elevation of 3570 feet, the company is sinking a 2-compartment vertical shaft, its present depth being 700 feet. This shaft is located 2500 feet south of the California Rand Silver Mining Company's main shaft, and 1000 feet south of the Bray-Bisbee shaft on the Rand Silver King group.

The shaft was sunk 140 feet through Lake Bed formation to schist, and in the schist it cut a number of N. 30° E. fissures which dip 60 to 65 degrees northeast. These fissures are filled with quartz and calcite, mineralized with pyrite, and some stibnite.

In the Black Hawk Mine a new shoot of ore west of the Blue fault has been developed on the 100-foot level. The shoot is 65 feet in length, with an average width of 3 feet, and is said to average \$50 per ton in gold.

Three parallel quartz veins occur in the schist, with general north strike and dip 50 degrees to the east. Width of veins 18 inches to 3 feet. Free milling gold quartz; value \$7 to \$50 per ton.

Developments: Black Hawk shaft 250 feet, with levels at 50 feet, 100 feet, 200 feet and 4000 feet of drifts and crosscuts on the Black Hawk vein. Pittsburg shaft 700 feet vertical. Bevis Divide shaft, 160 feet.

Electric power is secured from the Southern Sierras Power Company.

Mine equipment: At the Black Hawk shaft, 20-horsepower direct connected electric hoist. At the Pittsburg shaft, 50-horsepower electric hoist, and 12" x 10" compressor. At the Bevis Divide shaft, 25-horsepower electric hoist.

Mill equipment: 5 stamps, weight 1000 pounds. The ore is crushed through 40-mesh, followed by amalgamation. Fifteen men are employed.

Bibliography: Report XIV, State Mineralogist, p. 489.

California Rand Silver, Inc. Alfred Harrell, president; Charles S. Meroney, general manager; controls 21 claims, with a total area of 240 acres in the Rand Mining District. The property has been a steady producer since its discovery in April, 1919.

The capacity of the mill has been lately increased from 150 tons to 200 tons per day. During the month of May, the mine produced 7800 tons of milling ore, and 1034 tons of ore were shipped to the smelter. The mill produced 680 tons of concentrates, with an average value of \$288.83 per ton. The total smelter returns for the month were \$283,-298.51. The regular monthly dividend of 10 cents per share, a total of \$153,600, has been distributed to the stockholders of the company. Since the property has been in operation, it has paid in dividends \$2,553,600.

Mizpah-Montana Mine consists of the following claims: Mizpah Extension and Montana-Fraction, approximately 20 acres located in Secs. 1 and 6, T. 30 S., R. 40 and 41 E., 1½ miles southeast of Randsburg. Elevation 3800 feet.

Owners, Mizpah-Montana Mining Company, Hopkins Building, Bakersfield. Herman T. Miller, president; Frank Smith, secretary; G. Cleveland Taylor, superintendent.

The country rock is granite and schist. Two parallel veins, which strike N. 60° and dip 60 degrees southeast, occur in the granite on the

Mizpah Extension claim. Width of veins is from 8 to 12 inches. A 2-compartment shaft has been sunk to a vertical depth of 700 feet. The shaft is in granite for a distance of 400 feet, at which point it cut the schist.

Levels were driven at 102, 166, 236, 493 feet. On 100-foot level there is a drift north 80 feet, and south 80 feet; on the 200-foot level, a drift southeast 80 feet; on the 500-foot level, a drift west 260 feet, and east 100 feet. On the 100-foot level the drift cut a north and south fracture in the granite, which showed some ruby silver. On the 500-foot level in the east drift a well-defined fracture was cut which strikes N. 40° E. and dips 60 degrees east. The vein material in this fracture is brecciated and mineralized with pyrite and stibnite. Width of mineralized schist is from 4 to 8 feet. The company has an option on the Cuve claim, and it is proposed to develop this property from the 700-foot level.

Mine equipment consists of 50-horsepower electric hoist, 12" x 10" Ingersoll-Rand compressor, driven by 50-horsepower motor, air drills, cars and blacksmith shop. Eight men are employed.

Mizpah-Nevada Mine consists of New, Spider, Fraction, and Mistake claims, located in Secs. 1 and 6, T. 30 S., R. 40 and 41 E., 1½ miles southeast of Randsburg. Elevation 3850 feet. Owners, Mizpah-Nevada Mining Company, 314 Hopkins Building, Bakersfield. M. F. Pearson, president; F. J. Burns, secretary; G. Cleveland Taylor, manager.

Three parallel quartz veins occur in the granite. They strike N. 60° E., and dip from 75 degrees to vertical. Widths are 6 to 12 inches. Development consists of vertical 2-compartment shaft 150 feet deep and crosscutting on the 150-foot level to develop veins exposed on the surface east of the shaft. The company is planning to sink the shaft an additional 150 feet to cut the schist.

Mine equipment consists of 6-horsepower Fairbanks-Morse gas engine hoist, air drills, cars and blacksmith shop. Air is secured from the Silver Moon Mining Company. Four men are employed.

Rand Contact Mine comprises the following claims: Inyo, Body, American and Limestone, approximately 80 acres, located in Secs. 7, 12, 13 and 18, T. 30 S., R. 40 and 41 E., 3 miles southwest of Johannesburg. A quartz vein occurs on the contact of the schist and granite, striking northeast and southwest and dipping 45 degrees to southeast. Width is 12 inches to 2 feet. Development consists of 2-compartment vertical shaft sunk to a depth of 100 feet. A crosscut is being driven on the 100-foot level to the southeast to intersect the contact. Two parallel faults occur north and south of the shaft, which strike N. 45° W. and dip 70 degrees northeast, intersecting the contact to the southeast of the shaft.

Equipment consists of 10-horsepower Fairbanks-Morse gas-engine hoist, cars and blacksmith shop.

Owners, Rand Contact Mining Company, 506 S. Hill Street, Los Angeles. S. G. Dixon, president; L. A. Shaftner, secretary; Dr. M. A. Varichey, vice president; E. G. Dixon, manager. Four men are employed.

Silver Basin Mine (Gold). Formerly known as *Golden Era* group, consisting of the following claims: *Golden Era*, *Hidden Treasure*, *Ransome*, *O'Farrell*, *Fraction*, *Mandan Fraction*, *Y. W. Fraction*; 60 acres, located in Sec. 7, T. 30 S., R. 41 E., $2\frac{1}{2}$ miles southeast of Randsburg. Elevation 3600 feet.

Owners, *Silver Basin Mining Company*, Bakersfield. Kent S. Knowlton, president; Ray Woods, secretary; Leonard Lohr, manager.

Two parallel quartz veins occur in the schist, striking northwest and dipping 70 degrees northeast. Width is 12 inches to 3 feet.

The quartz is stained with iron oxide, and shows free gold.

Developments: *Hidden Treasure* shaft, 240 feet; *Golden Era* shaft, 50 feet. Present work is confined to the *Golden Era* vein. Here the vein prospects well in gold, and samples taken from shafts sunk along the vein for a distance of 100 feet, are said to have given values of from \$50 to \$150 per ton in gold. The company recently purchased the equipment of the *Ben Hur Company*, and are planning to sink the present *Golden Era* shaft to a greater depth. Six men are employed.

Silver Belle Mine comprises the following claims: *Silver Belle* and *Silver Belle No. 1*, approximately 20 acres, located in Sec. 6, T. 30 S., R. 41 E., 2 miles southeast of Randsburg. Elevation 3800 feet.

Owners, *Silver Belle Mining Company*. Edward Burge, president; N. R. Solomon, secretary; C. E. Pearce, superintendent. Property was under continuous development during 1921 and 1922 but operations were suspended in July, 1923. Development consists of 2-compartment vertical shaft 700 feet deep, with two levels, one at 500 feet, and the other at 700 feet. Crosscuts were driven 400 feet west on the 500-foot level, and 300 feet east on the 700-foot level. This shaft was sunk northwest of the Big Dike fault, in hopes of developing ore which occurs on the north and south, and N. 40° E. fractures of the California Rand Silver Mining Company's property. On the 500-foot level a series of north and south fractures were cut in the schist, which were mineralized with pyrite and stibnite with small values in gold and silver.

It is reported that the company plans to resume operations at an early date and is planning to sink the present shaft to a depth of 1000 feet.

Silver Glance comprises 10 acres on the *Silver King* group of claims, under lease to the *Silver Glance, Inc.*, of Bakersfield. E. J. Emmons, president; S. L. Pearce, secretary and manager.

The property is located southeast of Osdiek on the western slope of Red Mountain. Development consists of 2-compartment vertical shaft, 250 feet deep. The company plans to sink this shaft to a depth of 700 feet, which is the probable distance that the shaft will have to be sunk through the Lake Beds formation to cut the schist.

The shaft is located about 1000 feet northeast of the *Silver King* shaft in which some high grade silver ore was developed.

Equipment consists of 6-horsepower gas engine hoist. Six men are employed.

South Rand (Gold) comprises the Igo claim and 80 acres of patented land, located in Sec. 16, T. 30 S., R. 40 E., 6 miles south of Randsburg, on the southeast slope of Rand Mountains. Elevation 4200 feet.

Owners, South Rand Mining Company. E. L. Burton, president; S. L. Pearce, secretary and manager.

Two parallel quartz veins occur in schist. They strike east and dip 45 to 60 degrees south. Widths are 12 inches to 2 feet.

Development consists of shaft 60 feet deep, and tunnel 50 feet in length, with winze 30 feet deep on the vein. The company is sinking a shaft on one of the veins, and proposes to sink to a depth of 300 feet before drifting on the vein.

Equipment consists of 12-horsepower gas-engine hoist, blacksmith shop and cars. Three men are employed.

St. Lawrence Rand Mine comprises 180 acres, located in Sec. 1, T. 30 S., R. 40 E., 2 miles southeast of Randsburg. Elevation 3680 feet.

Owners, *California Rand Silver, Inc.*, under lease to the St. Lawrence Rand Mining Company. Land Building, Bakersfield; M. A. Dular, president; E. H. Richards, secretary.

Two parallel quartz veins occur in the schist. They strike N. 70° E. and dip 65 degrees south. Widths are 12 inches to 4 feet. The vein filling is quartz, calcite, and mineralized schist; the minerals contained being pyrrargyrite, stephanite, cerargyrite, stibnite and pyrite, with some gold values. Two shafts have been sunk on the K. C. N. vein; No. 1 shaft being 275 feet deep on an inclination of 67 degrees. No. 2 shaft is an incline shaft 300 feet deep. The present development work is confined to No. 1 shaft. Levels have been driven at 100 feet, 200 feet and 240 feet. On the 200-foot level there is a drift 250 feet east, and 40 feet west; on the 240-foot level, a drift 250 feet east, connecting with No. 2 shaft. On the 240-foot level about 230 feet east of the shaft a shoot of ore has been developed 40 feet in length with average width of 4 feet. A winze has been sunk on this shoot to a depth of 50 feet. Smelter returns from 6000 pounds of ore from this ore body were \$75 per ton in gold and silver. Samples taken from the vein are said to have an average content of 20 ounces in silver with \$5 in gold.

Mine equipment consists of 35-horsepower electric hoist, 12" x 10" Ingersoll-Rand compressor driven by 75-horsepower motor, blacksmith shop, air drills and cars. Ten men are employed.

Treasure Hill Mine comprises one claim known as Treasure Hill, located in Sec. 1, T. 30 S., R. 40 E., 1½ miles southeast of Randsburg. Elevation 3750 feet.

Owners, Treasure Hill Mining Company, Bakersfield. Frederic Downer, president; George Rutherford, secretary; C. E. Lucas, manager.

Two quartz veins occur in the schist; one strikes N. 30° E. and the other N. 55° E., and dip 60 degrees southeast. Widths are 12 inches to 2 feet. The company is sinking a vertical 2-compartment shaft, present depth 485 feet, and is planning to sink to a depth of 600 feet before starting a level. It is reported that at a depth of 400 feet a mineralized vein 6 feet in width was cut which strikes N. 40° E. Samples taken from the vein showed \$3 to \$5 in gold. At a depth of 480 feet the shaft cut a north and south fracture, which was filled with quartz and calcite and mineralized with pyrite. Samples taken are reported to assay from \$5 to \$20 in gold.

Mine equipment: 20-horsepower gas-engine hoist, blasksmith shop, air drills, and cars. Air is secured from Silver Moon Mining Company. Eight men are employed.

Unitcā Mines, Inc. (Gold) has a bond and lease on the *Bully Boy* group of claims, totaling 110 acres, located in Secs. 11 and 12, T. 30 S., R. 40 E., 2 miles south of Randsburg. Elevation 4150 feet. Operating company is known as United Mines, Inc.; C. R. Hannaman, president; M. J. McVan, secretary; S. L. Pearce, manager.

During the year 1922, the property was operated by the *Nugget Gold Mining Company*, but it was acquired by the present company in July, 1923. A series of parallel narrow quartz veins occur in the schist. Strike is N. 40° E. and dip 50 degrees northeast. Widths are 6 to 12 inches. A number of shafts have been sunk on the different veins from 50 to 100 feet. The main working shaft has been sunk on an incline of 53 degrees to a depth of 100 feet, on the Bully Boy vein. On the 50-foot level there is a drift west 150 feet on the vein; on the 100-foot level, a drift west 50 feet. About 150 feet west of this shaft there is an incline shaft on the vein to a depth of 60 feet, and about 250 feet west of this shaft is another shaft 170 feet deep. The area between these two shafts has been stoped to a depth of 60 feet, at which point the ore was cut off by a horizontal fault.

Mine equipment consists of a 60-horsepower West Coast gas-engine hoist, 10" x 10" Chicago pneumatic compressor, blacksmith shop and mine dwellings. Four men are employed.

White Horse Mine comprises the following claims: White Horse and High Grade Ridge, totaling 11 acres, located in Sec. 1, T. 30 S., R. 40 E., 2 miles southeast of Randsburg. Elevation 3550 feet.

Owners, White Horse Mining Company, Selma, California. A. Sager, president; C. Campbell, secretary; S. L. Pearce, manager.

Two parallel quartz veins occur in the schist northeast of the shaft. They strike N. 30° E., and N. 55° E. and dip 50 degrees southeast. Widths are 12 inches to 2 feet. Six shafts have been sunk on these two veins to depths of 40 to 50 feet. The company is sinking a 2-compartment vertical shaft, present depth 200 feet, and is planning to sink to a depth of 500 feet, in the hopes of cutting the silver bearing ore zone. The shaft intersected No. 1 vein at a depth of 120 feet, and should cut No. 2 vein at a depth of 400 feet.

Mine equipment consists of 20-horsepower gas-engine hoist. Six men are employed.

FREMONT MINING DISTRICT.

This district is situated 20 miles southeast of Randsburg, in T. 31 and 32 S., R. 42 E., in a range of mountains which run in a north-westerly direction, of which Fremont Peak is 4600 feet above sea level and 1800 feet above the general level of the desert. A number of smaller hills are grouped south and southeast of Fremont Peak, and are included in the district.

In the southern end of the district, the Silver Dome Mine is located on a low range of hills, the highest peak having an elevation of 2831 feet. Fremont Peak and the surrounding low ranges of hills are of

igneous or volcanic origin. Granite underlies the entire district, and rhyolite-porphyry lies upon and in contact with the granite. In the southern portion of the district where the Silver Dome Mine is situated, a belt of limestone occurs south of the granite area, and makes up the crest of the low range of hills.

Fremont Peak Mine is situated on the western slope of Fremont Peak, at an elevation of 3700 feet. Holdings consist of 12 claims, 240 acres, in T. 31 S., R. 41 E., 18 miles southeast of Randsburg. Owner, L. A. Mason, Oakland. Under option to *Monarch Mining Company*, Randsburg; John C. Kellar, president; A. B. Hall, manager.

A series of parallel quartz veins occur in the granite, and also on the contact of the granite and rhyolite-porphyry dikes. The veins have a general east and west course, dip 70 degrees north, widths varying from 12 inches to 2 feet.

Development consists of an incline shaft 100 feet deep, with levels at 50 and 100 feet. On 50-foot level there is a drift west 125 feet, and 100 feet east. In the west drift on the 50-foot level, about 20 feet west of the shaft, the vein is cut by a north and south fault, dipping 60 degrees east. This fault cut off the ore shoot. A pay shoot has been developed 60 feet in length west of the fault. Its average width is 12 inches, and it is said to average from \$25 to \$50 per ton. One-quarter mile southeast of the shaft, at an elevation of 3800 feet, are two cross-cut tunnels about 50 feet apart; No. 1 Tunnel being 100 feet. No. 2 Tunnel is located 50 feet east of No. 1, is driven 60 feet south to No. 1 vein on a rhyolite dike, then drifted 100 feet east on the vein, and cross-cut 90 feet south to No. 2 vein. The veins occur on both walls of a rhyolite dike. They have a width of 6 to 8 inches, strike east and west, and dip 35 degrees north. Near the crest of the ridge, at an elevation of 4000 feet, a tunnel has been driven 200 feet east on a narrow vein of quartz 4 to 6 inches wide, which dips 35 degrees north.

Equipment: 10-horsepower gas-engine hoist, cars, blacksmith shop and dwellings. Twelve men are employed.

Silver Dome Mine comprises 10 claims along the lode veins, and 160 acres covering the limestone deposit, totaling 360 acres, located in Sec. 32, T. 12 N., R. 42 E., 20 miles southeast of Randsburg.

Owners, *Silver Dome Mining Company*, Phoenix, Arizona; Capt. A. Rolling, president; F. Knappin, secretary.

Country rock is granite and limestone. Four parallel veins occur in the granite. These veins occur along fault fissures in the granite, which strike east, and dip from 45 degrees to 65 degrees north. The vein filling is quartz, calcite and inclosed wall rock, mineralized with chalcopyrite, pyrite and bornite, with values in gold and silver. Widths vary from 4 to 8 feet.

Developments: A shaft has been sunk on one of these parallel veins on an incline of 45 degrees for 200 feet. Here the vein straightens to 85 degrees, and the shaft follows the vein on its dip for 103 feet. At a depth of 265 feet, a drift is driven on the vein 100 feet east and 50 feet west. The ore developed on this level is reported to carry from 3 to 12 per cent copper, \$7 to \$20 in gold, and 7 to 15 ozs. of silver.

A number of intrusive diabase dikes occur in the granite, and one of these dikes forms the footwall of the vein on the 265-foot level.

Mine equipment: 25-horsepower Western gas engine hoist, two 9" x 14" Chicago pneumatic compressors, a No. 5 Cameron pump, cars, trucks, blacksmith shop and dwellings.

A water supply is secured from springs and from the shaft.

Fifteen men are employed. Capt. A. Rolling, manager.

ORO GRANDE DISTRICT.

Ophir Mine, located six miles northeast of Oro Grande, has been taken over by the *Rentchler Mines Company* of Los Angeles; Harvey G. Wolf, president; C. A. De Coe, secretary.

The property consists of four claims, and is developed by three shafts from 185 to 300 feet in depth. The company is planning to install an electric-driven hoist, and to start development work on the property at an early date.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. E. COLLOM, State Oil and Gas Supervisor.

Early in April of 1923, petroleum production in California had apparently reached the saturation point. The average daily production for the state had increased from 325,000 barrels daily in April, 1922, to 715,000 barrels daily in 1923. After reaching the 700,000 barrel mark at the beginning of April, 1923, the average daily production, up to the time of this report, June 15, 1923, remained close to 700,000 barrels per day.

This did not signify, however, that the peak of production had been reached. It simply meant that 700,000 barrels per day represented the maximum capacity of California's storage, transportation and marketing system, and therefore producers found it necessary to 'pinch in' flowing wells and otherwise curtail production.

Development operations at Huntington Beach, Long Beach and Santa Fe Springs oil fields being responsible for the overproduction of crude oil in the state, operators in those fields, working in cooperation with marketing companies, started in May, 1923, to restrict the normal flow of wells by 30 per cent in order to keep production down.

The logical means of curtailing production was to stop drilling. However, the complicated interests of lessors, royalty holders, drilling contractors and town-lot operators, seem to have made a concerted effort in this direction impossible. The next best step was to 'pinch in' production of wells already drilled even though drilling and the bringing in of new wells could not be stopped.

Four reductions in the value of the crude product within a year caused no appreciable check in drilling. Over 600 wells were drilling in the three fields on June 10, 1923. These were distributed as follows: Huntington Beach 154, Long Beach 275, and Santa Fe Springs 247. The movement to restrict the output of individual wells will further curtail the profits derivable from each producing unit. The oversupply is being more actively maintained by initial productions of wells just completed than the rapidly declining old wells. Initial production of 12 wells recently completed at Santa Fe Springs averaged 3950 barrels per well as compared with an average daily production of 1600 barrels per well for all producing wells in the field.

Initial productions for wells brought in at Santa Fe Springs during the week ending May 31, 1923, were as follows:

Initial Productions Santa Fe Springs Oil Field.

Company	Well No.	Depth of completion, feet	Date of completion	Initial production in barrels per day
George F. Getty.....	"Parcell" 8	4700	May 30	6700
Wilshire Oil Co.....	"Surbeck" 3	4666	May 24	2250
White Star Oil Syn.....	1	4679	May 25	3000
Petroleum Midway Co., Ltd.....	"Patterson" 4	4908	May 28	2000
Standard Oil Company.....	"So. Whittier Com." 9	4765	May 29	500

At Santa Fe Springs oil field 112 wells were producing 235,755 barrels daily on May 24, 1923, prior to the general move to 'pinch in' production. On May 31, 1923, after the 30 per cent curtailment of

production was put into effect, and after the five new wells listed above had come in, the average daily production was 232,158 barrels, an actual net curtailment of 3597 barrels, or 1.6 per cent.

It should be borne in mind—in this town-lot development—that an appreciable amount of drilling has been financed by people not experienced in the oil industry. They have invested in things hoped for rather than seen. Probably such drilling will continue regardless of the profit that can be realized from the product. It is estimated that \$58,000,000 has been expended in drilling alone since these fields started. The three fields have produced approximately 107,130,000 barrels from January 1, 1921, to June 1, 1923.

At the beginning of 1921 there were 43 producers of petroleum in Los Angeles and Orange counties. In January, 1923, the number of producers had increased to 175.

There has been no material change in the number of marketing concerns. Five of the large marketing companies of California are confronted with the huge task of taking care of a major portion of the production, providing transportation, storage and refining facilities, for a greater additional quantity of crude oil than these same companies handled throughout the entire plant of the industry at the beginning of 1921.

As of June 1, 1923, the following is the status of operations of the three southern fields which dominate the oil situation in California:

Field	^a Wells drilling	Wells idle	Wells producing	Average daily production, barrels	Average daily production per well, barrels	Drilling below 4000 feet
Long Beach.....	275	64	181	192,693	1,062	-----
Huntington Beach.....	154	131	168	110,914	656	-----
Santa Fe Springs.....	247	26	112	232,158	2,070	133
Total.....	676	221	461	535,765	792.5	133

From March 10, 1923, to and including April 7, 1923, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY:					
Pan American Petroleum Co.....	34	30	24	13	Elk Hills
Pan American Petroleum Co.....	25	30	23	1	Elk Hills
Berry & Ewing.....	31	32	24	1	Midway
Brookshire Oil Co.....	24	31	22	10	Midway
C. C. M. O. Co.....	22	31	22	27	Midway
C. C. M. O. Co.....	22	31	22	25	Midway
C. C. M. O. Co.....	22	31	22	26	Midway
C. C. M. O. Co.....	25	31	22	12	Midway
C. C. M. O. Co.....	9	32	23	28	Midway
Formax Oil Co.....	36	32	23	4	Midway
Fresno Five Oil Co.....	36	32	23	1	Midway
Mascot Oil Co.....	36	32	23	1	Midway
Midland Oil Fields Co., Ltd.....	34	31	24	1	Midway
Pacific Oil Co.....	31	31	24	223	Midway
Pacific Oil Co.....	35	31	23	75	Midway
Pacific Oil Co.....	1	32	23	111	Midway
Pacific Oil Co.....	1	32	23	63	Midway
Pacific Oil Co.....	27	31	23	62	Midway
Pacific Oil Co.....	29	32	24	30	Midway
Kerntaft Petroleum Co.....	29	12	24	1	Sunset
Standard Oil Co.....	28	11	20	4	Wheeler Ridge
Kern-Torrance Petroleum Co.....	13	9	10	1	-----
Main Oil Co. of California.....	28	27	24	1	-----

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY:					
A. & P. Syn.....	24	4	13	1	Long Beach
Bemco Oil Syn. No. 1.....	24	4	13	1	Long Beach
Benwell Drilling Co.....	30	4	12	Benwell 3	Long Beach
Bona Fide Oil Corp.....	30	4	12	Poole Hawkins 2	Long Beach
Albert L. Cheney, trustee.....	30	4	12	1	Long Beach
Crescent Oil Co.....	19	4	12	1	Long Beach
Coast States Oil Co.....	30	4	12	2	Long Beach
Coast States Oil Co.....	30	4	12	May Richards 1	Long Beach
Dabney Oil Syn.....	30	4	12	22	Long Beach
Geo. F. Getty.....	24	4	13	8	Long Beach
Geo. F. Getty.....	19	4	12	Long Beach 9	Long Beach
Graham & Loftus Oil Co.....	19	4	12	2	Long Beach
Graham & Loftus.....	30	4	12	Lightburn 2	Long Beach
H. & T. Syn.....	30	4	12	2	Long Beach
Harmony Dobyns Oil Syn.....	30	4	12	3	Long Beach
Hawthorne Oil Co.....	19	4	12	2	Long Beach
Hull Brennan Syn.....	19	4	12	1	Long Beach
A. T. Jergins Trust.....	19	4	12	3	Long Beach
A. T. Jergins Trust.....	19	4	12	6	Long Beach
McGregor Syn. No. 2.....	29	4	12	1	Long Beach
Mack Number One Trust.....	30	4	12	1	Long Beach
Marine Oil Corp.....	19	4	12	6	Long Beach
E. J. Miley.....	13	4	13	5	Long Beach
M. H. Mosier Special.....	19	4	12	1	Long Beach
Painted Hills Oil Assn.....	20	4	12	4	Long Beach
Petroleum Midway Co., Ltd.....	19	4	12	Fields 3	Long Beach
Petroleum Midway Co., Ltd.....	19	4	12	O'Neill 1	Long Beach
Rice Ranch Oil Co.....	19	4	12	5	Long Beach
Shell Co.....	29	4	12	Bixby 2	Long Beach
Shell Co.....	29	4	12	Jones Com. 4	Long Beach
Shell Co.....	29	4	12	Nichelson 3	Long Beach
Shell Co.....	29	4	12	Mills 1	Long Beach
Shell Co.....	29	4	12	Patton Wilson 2	Long Beach
Tehmescal Oil Co.....	20	4	12	5-A	Long Beach
Union Oil Co.....	29	4	12	Hart 3	Long Beach
Union Oil Co.....	29	4	12	Hart 2	Long Beach
United Oil Co.....	13	4	13	Bixby 1	Long Beach
U. S. Royalties Co.....	24	4	13	1	Long Beach
Wigle & McBride.....	19	4	12	Thompson 1	Long Beach
Kenneth R. Woolley.....	30	4	12	10	Long Beach
Kenneth R. Woolley.....	30	4	12	8	Long Beach
Amalgamated Oil Co.....	6	3	11	Green 2	Santa Fe Springs
Amalgamated Oil Co.....	6	3	11	Green 1	Santa Fe Springs
Amalgamated Oil Co.....	31	2	11	Dallugge 5	Santa Fe Springs
Amalgamated Oil Co.....	6	3	11	Dewenter 3	Santa Fe Springs
American Oil Syn.....	18	3	11	1	Santa Fe Springs
Associated Oil Co.....	1	3	12	Clarke 1	Santa Fe Springs
Associated Oil Co.....	1	3	12	Clarke 2	Santa Fe Springs
Associated Oil Co.....	1	3	12	Clarke 3	Santa Fe Springs
Brady & Well Syn.....	8	3	11	2	Santa Fe Springs
Buckeye Union Oil Co.....	5	3	11	4	Santa Fe Springs
Cecelia Petroleum Co.....	6	3	11	1-A	Santa Fe Springs
Co-Operative Petroleum Syn. No. 3.....	35	2	12	3	Santa Fe Springs
Equitable Oil Syn.....	17	3	11	1	Santa Fe Springs
Fred B. Foster & Co.....	6	3	11	50	Santa Fe Springs
Fred B. Foster & Co.....	1	3	12	52	Santa Fe Springs
General Petroleum Corp.....	6	3	11	Santa Fe 79-C	Santa Fe Springs
General Petroleum Corp.....	5	3	11	Santa Fe 43	Santa Fe Springs
General Petroleum Corp.....	5	3	11	Santa Fe 52-B	Santa Fe Springs
George F. Getty.....	5	3	11	13	Santa Fe Springs
Oscar R. Howard.....	6	3	11	Hathaway 3	Santa Fe Springs
Industrial Oil Syn. No. 3.....	7	3	11	32	Santa Fe Springs
C. C. Julian.....	1	3	12	5	Santa Fe Springs
C. C. Julian.....	6	3	11	7	Santa Fe Springs
C. C. Julian.....	1	3	12	8	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Three 4	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Two 5	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Patterson 8	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Three 5	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Three 6	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Two 4	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Three 7	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Mattern Three 2-A	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Steinly 2	Santa Fe Springs
Petroleum Midway Co., Ltd.....	6	3	11	Baldwin 2	Santa Fe Springs
Santa Fe Bell Oil Co.....	12	3	12	1	Santa Fe Springs
Shell Co.....	31	2	11	G.H.N. 5	Santa Fe Springs
Shell Co.....	6	3	11	Slusher 3	Santa Fe Springs
Standard Oil Co.....	6	3	11	Weisel 2	Santa Fe Springs
Standard Oil Co.....	5	3	11	S. Whittier Com. 14	Santa Fe Springs
Standard Oil Co.....	6	3	11	Weisel 3	Santa Fe Springs
Standard Oil Co.....	31	2	11	Santa Gertrudes 3-A	Santa Fe Springs
Standard Oil Co.....	6	3	11	Weisel 4	Santa Fe Springs

Company	Sec.	Twsp.	Range	Well No.	Field
LOS ANGELES CO.—Cont.					
Stewart Anderson Syn.....	7	4	11	1-A	Santa Fe Springs
U. S. Royalties Co.....	6	3	11	2	Santa Fe Springs
Universal Cons. Oil Co.....	6	3	11	2	Santa Fe Springs
Wilshire Oil Co.....	6	3	11	1	Santa Fe Springs
C. C. M. O. Co.....	8	4	14	Del Amo 7	Torrance
George F. Getty.....	15	4	14	2	Torrance
Peterson-Barker Syn.....	12	4	14	1	Torrance
Petroleum Midway Co., Ltd.....	9	4	14	Gish 1	Torrance
Hoard & Scully.....	26	1	13	1	-----
D. Herbert Hostetter.....	3	2	13	1	-----
ORANGE COUNTY:					
Petroleum Products Syn.....	14	3	11	1	Coyote Hills
Amalgamated Oil Co.....	34	5	11	Fowler 7	Huntington Beach
Fred B. Foster & Co.....	2	6	11	51	Huntington Beach
Jameson Oil Co.....	2	6	11	Block B 2	Huntington Beach
McKeon Syn.....	2	6	11	1	Huntington Beach
Miley Keck Oil Co.....	35	5	11	23	Huntington Beach
Miley Keck Oil Co.....	2	6	14	38	Huntington Beach
Miley Keck Oil Co.....	2	6	11	41	Huntington Beach
Pacific Petroleum Corp.....	2	6	11	10	Huntington Beach
Petroleum Midway Co., Ltd.....	2	6	11	Pearce 2	Huntington Beach
Petroleum Midway Co., Ltd.....	2	6	11	Elliott 3	Huntington Beach
Shell Co. (U. D.).....	34	5	11	Ashton 8	Huntington Beach
Shell Co. (U. D.).....	34	5	11	Ashton 7	Huntington Beach
Standard Oil Co.....	2	6	11	Hunt. B. 21	Huntington Beach
Standard Oil Co.....	2	6	11	Hunt. B. 22	Huntington Beach
Standard Oil Co.....	29	5	11	Bolsa 9-A	Huntington Beach
Standard Oil Co.....	12	6	11	Farnsworth 2-A	Huntington Beach
U. S. Royalties Co.....	2	6	11	1	Huntington Beach
Western Petroleum Corp.....	2	6	11	1	Huntington Beach
White Behr Petroleum Syn.....	2	6	11	Jackie Coogan 5	Huntington Beach
Union Oil Company.....	29	3	9	Chapman 23	Richfield
RIVERSIDE COUNTY:					
Cheney Oil Lease Syn.....	14	2	3	1	-----
SAN DIEGO COUNTY:					
Mission Bay Oil Co.....	29	16	3	1	-----
SAN MATEO COUNTY—					
Elk Hills Pool Oil Co.....	Ormonde	Ranch		1	-----
Northern Exploration Co.....	21	7	4	1	-----
SANTA BARBARA COUNTY:					
Jalama Oil & Development Co.....	*	7	33	1	-----
Jalama Oil & Development Co.....	*	7	33	2	-----
VENTURA COUNTY:					
Bardsdale Crude Oil Co.....	12	3	20	9	Bardsdale
National Drilling & Dev. Co.....	28	4	23	1	Ojai
Buena Ventura Oil Co.....	14	4	18	1	Piru
Santa Paula Oil Co.....	18	3	20	Santa Paula 16	South Mountain
R. L. Hinckley.....	33	4	23	15	Ventura

*Barker Ranch, Santa Rosa Rancho.

From April 7, 1923, to and including June 9, 1923, the following new well's were reported as ready to drill:

Company	Sec.	Twsp.	Range	Well No.	Field
FRESNO COUNTY:					
West Coalinga Oil & Dev. Co.....	6	21	15	3	Coalinga
Fresno United Oil Co.....	23	15	18	2	-----
KERN COUNTY:					
Mendocino Midway Oil Syn.....	6	30	24	2	Elk Hills
Pacific Oil Co.....	35	30	24	40	Elk Hills
Pacific Oil Co.....	35	30	24	87	Elk Hills
Pan American Pet. Co.....	34	30	24	17	Elk Hills
Pan American Pet. Co.....	34	30	24	16	Elk Hills
Pan American Pet. Co.....	34	30	24	15	Elk Hills
Pan American Pet. Co.....	34	30	24	14	Elk Hills
J. J. Kelly.....	31	28	29	1	Kern River
Berry & Ewing.....	31	32	24	11	Midway
Big Ten Oil Co.....	36	32	23	1	Midway
Big Ten Oil Co.....	36	32	23	2	Midway
Boston Pacific Oil Co.....	32	31	24	2-D	Midway
C. C. M. O. Co.....	9	32	23	29	Midway
C. C. M. O. Co.....	25	31	22	13	Midway
C. C. M. O. Co.....	26	31	22	8	Midway
C. C. M. O. Co.....	22	31	22	32	Midway

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Christine Oil Syn.	21	31	22	2	Midway
Honolulu Cons. Oil Co.	6	32	24	13	Midway
Honolulu Cons. Oil Co.	6	32	24	14	Midway
Honolulu Cons. Oil Co.	6	32	24	28	Midway
Honolulu Cons. Oil Co.	6	32	24	12	Midway
Formax Oil Co.	36	32	23	6	Midway
Formax Oil Co.	36	32	23	5	Midway
Kernstaff Petroleum Co.	36	32	23	1	Midway
North American Oil Cons.	30	31	24	2	Midway
Pacific Oil Co.	31	31	24	34	Midway
Pacific Oil Co.	31	31	24	35	Midway
Pacific Oil Co.	36	31	23	80	Midway
Pacific Oil Co.	5	32	24	70	Midway
Pacific Oil Co.	5	32	24	92	Midway
Pacific Oil Co.	15	32	24	92	Midway
Pacific Oil Co.	25	31	23	68	Midway
Surprise Oil Co.	36	32	23	8	Midway
Western Extension Oil Co.	6	31	23	1	Midway
Wm. G. McAdoo, Jr. and Robert K. Gilbert	34	11	20	1	Wheeler Ridge
A. A. Rollestone	32	11	20	1	Wheeler Ridge
Standard Oil Co.	28	11	20	Kern Co. 2	Wheeler Ridge
Big Eight Oil Co.	2	27	18	2	-----
Kern 29 Oil Co.	29	31	30	1	-----
KINGS COUNTY:					
Pacific Oil & Gas Co.	13	23	20	2	-----
Sagebrush Oil & Gas Co.	17	22	19	Lakeshore 3	-----
LOS ANGELES COUNTY:					
Angelus Syn.	19	4	12	3	Long Beach
Lou Anger Oil Syn.	19	4	12	2	Long Beach
W. A. Bartholomae, Jr.	24	4	13	3	Long Beach
Bay Hills Oil & Land Co.	24	4	13	Special Del. 1	Long Beach
Bay Hills Oil & Land Co.	19	4	12	Special Del. 2	Long Beach
Black Star Oil Co.	30	4	12	2	Long Beach
Bush-Voorhis Oil Co.	19	4	12	11	Long Beach
Cal. Co-Operative Syn. No. 2	24	4	13	1	Long Beach
Cal. Co-Operative Syn. No. 2	20	4	12	2	Long Beach
California Signal Syn. No. 3	30	4	12	3	Long Beach
Cal-Mex Oil & Refining Co.	19	4	12	Kirkpatrick 3	Long Beach
Carlton Petroleum Co.	24	4	13	1	Long Beach
Cook & Harpster	19	4	12	1	Long Beach
Cooper Petroleum Co.	19	4	12	Duncan 3	Long Beach
Core Oil Syn.	24	4	13	1	Long Beach
R. C. Cotton	24	4	13	1	Long Beach
Crown City Oil Co.	19	4	12	1	Long Beach
D. & H. Syn.	19	4	12	1	Long Beach
Dabney Oil Syn.	19	4	12	14-A	Long Beach
Dave Ebersole Oil Syn.	24	4	13	1	Long Beach
Walter H. Fisher	30	4	12	6	Long Beach
General Petroleum Corp.	28	4	12	Bixby 2	Long Beach
Geo. F. Getty	29	4	12	4-A	Long Beach
A. F. Gilmore Co.	24	4	13	Smith 1	Long Beach
Huntington & Northern Pet. Co.	19	4	12	9	Long Beach
Industrial Oil Syn. No. 4	19	4	12	41-A	Long Beach
Interstate Oil Corp.	29	4	12	Jones 1-A	Long Beach
A. T. Jergins Trust	19	4	12	7	Long Beach
Keck Syn. No. 4	30	4	12	3	Long Beach
Keck Syn. No. 5	24	4	13	3	Long Beach
Keck Syn. No. 6	24	4	13	1	Long Beach
E. G. Lewis	30	4	12	5	Long Beach
Long Beach Petroleum Syn.	24	4	13	1	Long Beach
Marine Oil Corp.	19	4	12	15	Long Beach
Marine Oil Corp.	29	4	12	19-A	Long Beach
Marine Oil Corp.	19	4	12	18	Long Beach
Old Colony Trust No. 1	30	4	12	1	Long Beach
Optic Oil Syn.	30	4	12	1	Long Beach
Pan American Petroleum Co.	19	4	12	U. P. 1	Long Beach
Pan American Petroleum Co.	19	4	12	U. P. 2	Long Beach
Pan American Petroleum Co.	19	4	12	U. P. 6	Long Beach
Pan American Petroleum Co.	19	4	12	U. P. 5	Long Beach
Pan American Petroleum Co.	29	4	12	Anderson 2	Long Beach
Petroleum Midway Co., Ltd.	29	4	12	Booth 1	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Gray 1-A	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Harlow 7	Long Beach
W. R. Ramsey	29	4	12	Coffin 1	Long Beach
Shell Co.	29	4	12	Pickler 5	Long Beach
Shell Co.	29	4	12	Cherry Hill Com. 4	Long Beach
Shell Co.	30	4	12	Burgess 1	Long Beach
Shell Co.	28	4	12	Connett 1-A	Long Beach
Shell Co.	29	4	12	Wilbur 3-A	Long Beach

Company	Sec.	Twp.	Range.	Well No.	Field
LOS ANGELES CO.—Cont.					
Shell Co.	29	4	12	Hughes 1	Long Beach
Shell Co.	29	4	12	Stakemiller 2	Long Beach
Shell Co.	29	4	12	Babb & Tucker 3	Long Beach
Shell Co.	29	4	12	Martin Com. 3	Long Beach
Shell Co.	29	4	12	Shell Fee Land 1	Long Beach
Shell Co.	19	4	12	Cresson 4	Long Beach
Shell Co.	29	4	12	Nesa 4-A	Long Beach
Southwestern Oil Syn.	30	4	12		Long Beach
Three for One Oil Royalties.	19	4	12	Kibbe & Yochem 1	Long Beach
Three for One Oil Royalties.	19	4	12	Maise 2	Long Beach
Three for One Oil Royalties.	30	4	12	Lovelady 1	Long Beach
Union Oil Co.	30	4	12	L. B. Com. 11	Long Beach
Union Oil Co.	30	4	12	L. B. Com. 10	Long Beach
United Oil Co.	19	4	12	Malc.-Davis 2	Long Beach
U. S. Oil Co.	30	4	12		Long Beach
U. S. Royalties Co.	24	4	13		Long Beach
West Coast Crude, Trust	24	4	13	Bishop 1	Long Beach
Western Oil Dev. Co.	24	4	13		Long Beach
Western Petroleum Corp.	19	4	12	Frog Pond 1-A	Long Beach
Western Petroleum Corp.	19	4	12	Gurnsey 1	Long Beach
Whiston, Winger & Co.	19	4	12	Fullerton 1	Long Beach
Wilshire Oil Co.	24	3	13	Gordon 1	Long Beach
Wilshire Oil Co.	24	3	13	Brady 1	Long Beach
Shell Co.	1	2	12		9-A
H. L. Whiston Co.	34	1	12		Montebello
Ambassador Petroleum Co.	6	3	11	Baker 4	Santa Fe Springs
Ambassador Petroleum Co.	6	3	11	Baker 2	Santa Fe Springs
Ambassador Petroleum Co.	6	3	11	Baker 3	Santa Fe Springs
J. E. Anderson	6	3	11		Santa Fe Springs
Associated Oil Co.	1	3	12	Clarke 6	Santa Fe Springs
Associated Oil Co.	1	3	12	Clarke 12	Santa Fe Springs
Bandini Petroleum Co.	6	3	11	Off 2	Santa Fe Springs
Boescke Syn.	1	3	12		2
Boescke Syn.	1	3	12		5
L. B. Chase Oil Co.	11	3	12		1
Elliott Extension Oil Co.	1	3	12		1
First National Petroleum Co.	35	2	12		1
Fred B. Foster & Co.	1	3	12		56
Fred B. Foster & Co.	1	3	12		61
General Petroleum Corp.	5	3	11	Santa Fe 1-A	Santa Fe Springs
General Petroleum Corp.	6	3	11	Santa Fe 86-C	Santa Fe Springs
General Petroleum Corp.	5	3	11	Santa Fe 13	Santa Fe Springs
General Petroleum Corp.	5	3	11	Santa Fe 12	Santa Fe Springs
General Petroleum Corp.	6	3	11	Santa Fe 90-B	Santa Fe Springs
General Petroleum Corp.	5	3	11	Santa Fe 14	Santa Fe Springs
Geo. F. Getty	5	3	11		14
Grunwell Oil Corp.	5	3	11		1
Hamilton Oil Syn.	7	3	11		6
Hopkins & Howland	6	3	11	Baker 2	Santa Fe Springs
Industrial Oil Syn.	6	3	11		12
C. C. Julian & Co.	6	3	11		12
Klausner & Co.	8	3	11		1
Klondyke Oil Co.	9	3	11		1
McKeon Drilling Co.	6	3	11	Bossick 1-A	Santa Fe Springs
Machris Bros. Syn. No. 2	5	3	11	Babonet 2	Santa Fe Springs
Machris Bros. Syn. No. 2	5	3	11	Landl 2	Santa Fe Springs
Parkford Royalty	6	3	11		1
Petroleum Midway Co., Ltd.	6	3	11	Mattern Two 3	Santa Fe Springs
Reid & Berliner	6	3	11	Reiber 1	Santa Fe Springs
Russell Petroleum Co.	1	3	12		6
Russell Petroleum Co.	1	3	12		3
Santa Fe Dome Syn. No. 2	8	3	11		1
Santa Fe Springs Oil Syn. No. 1	6	3	11		3-A
Shell Co.	31	2	11	G.H.N. 6	Santa Fe Springs
Shell Co.	6	3	11	Slusher 4	Santa Fe Springs
Shell Co.	31	2	11	G.H.N. 8	Santa Fe Springs
Southern California Oil Co.	6	3	11		1-A
Southwest Petroleum Syn.	35	3	12	Harris 1	Santa Fe Springs
Standard Oil Co.	31	2	11	Wolfskill 2	Santa Fe Springs
Standard Oil Co.	6	3	11	Weisel 6	Santa Fe Springs
Standard Oil Co.	31	2	11	Hepler 4	Santa Fe Springs
Standard Oil Co.	1	3	12	Watson 2	Santa Fe Springs
Standard Oil Co.	6	3	11	Weisel 5	Santa Fe Springs
Standard Oil Co.	36	2	12	Jordan 3	Santa Fe Springs
Superior Oil Co.	6	3	11	Wardman 3	Santa Fe Springs
Triangle Oil Syn. No. 2	7	3	11		2
Joe B. Turman Oil Syn.	12	3	12		3
Union Oil Co.	5	3	11	Meyer 1	Santa Fe Springs
Union Oil Co.	5	3	11	Farwell 6	Santa Fe Springs
Union Oil Co.	5	3	11	Farwell 8	Santa Fe Springs
Union Oil Co.	32	2	11	Farwell 9	Santa Fe Springs
Union Oil Co.	5	3	11	Farwell 5	Santa Fe Springs

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES CO.—Cont.					
United States Royalties Co.	6	3	11	3	Santa Fe Springs
Universal Cons. Oil Co.	6	3	11	4	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Fraser 3	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Fraser 2	Santa Fe Springs
York-Smullin Drilling Co.	5	3	11	Nordstrum 1	Santa Fe Springs
Amalgamated Oil Co.	8	4	14	Watson 2	Torrance
C. C. M. O. Co.	15	4	14	Torrance 8	Torrance
C. C. M. O. Co.	15	4	14	Torrance 9	Torrance
C. C. M. O. Co.	15	4	14	Torrance 7	Torrance
C. C. M. O. Co.	10	4	14	Torrance 11	Torrance
C. C. M. O. Co.	15	4	14	Torrance 10	Torrance
Hub Oil Co.	15	4	14	Smith 2	Torrance
Midway Northern Oil Co.	15	4	14	1	Torrance
Sentinel Oil Co.	15	4	14	1	Torrance
Trimble & Rhea	10	4	14	1	Torrance
U. S. Royalties Co.	10	4	14	9	Torrance
Amazon Drilling Corp.	5	2	14	Baldwin 1	-----
Calpetro Producers Syn.	15	3	12	2	-----
Calpetro Producers Syn.	15	3	12	2-A	-----
Coast Line Cons. Oils, Inc.	17	3	13	Sandburg Com. 1	-----
Dome Oil Co.	28	3	14	1	-----
C. C. Julian	29	3	13	Pico 1	-----
Keck Syn. No. 6	1	5	14	2	-----
Giant Petroleum Co.	5	3	12	1	-----
The Locators' Co.	27	2	14	3	-----
A. L. Olinger	17	4	13	1	-----
Reider-Haag Co.	35	1	17	2	-----
Santa Fe Western Ext.	9	3	12	1	-----
ORANGE COUNTY:					
Birch Oil Co.	2	3	10	11-A	Brea Olinda
Standard Oil Co.	18	3	10	M-C 99	Coyote Hills
Auburn Oil Co.	2	6	11	2	Huntington Beach
Barnett Anchor Oil Co.	2	6	11	3	Huntington Beach
Bolsa Chica Petroleum Corp.	2	6	11	3	Huntington Beach
Dodge Syn.	34	5	11	1	Huntington Beach
Federal Drilling Co.	35	5	11	1	Huntington Beach
Globe Petroleum Corp.	35	5	11	La Bolsa Tile 1	Huntington Beach
Gypsy Oil Syn.	11	6	11	Judson House 5	Huntington Beach
Holly Development Co.	2	6	11	Turley 4	Huntington Beach
Invader Oil Co.	2	6	11	Miller 1-A	Huntington Beach
Pan American Petroleum Co.	2	6	11	3	Huntington Beach
Pan American Petroleum Co.	2	6	11	5	Huntington Beach
Pan American Petroleum Co.	34	5	11	6	Huntington Beach
E. A. Parkford	1	6	11	1	Huntington Beach
E. A. Parkford	1	6	11	Wright 1	Huntington Beach
Petroleum Midway Co., Ltd.	35	5	11	Savage 2	Huntington Beach
Petroleum Midway Co., Ltd.	2	6	11	Columbia 3	Huntington Beach
Petroleum Midway Co., Ltd.	2	6	11	Columbia 1	Huntington Beach
Reliance Oil Co.	34	5	11	1	Huntington Beach
Republic Prod. Co.	2	6	11	Crane 9	Huntington Beach
Republic Prod. Co.	2	6	11	Kirk 7	Huntington Beach
Fred Ruether	35	5	11	1	Huntington Beach
Ryan Petroleum Syn.	34	5	11	1	Huntington Beach
Sequoia Oil Co.	30	5	11	1	Huntington Beach
Standard Oil Co.	12	6	11	Thomson 3	Huntington Beach
Standard Oil Co.	13	6	11	Surf 3	Huntington Beach
Union Oil Co.	35	5	11	Copeland 20	Huntington Beach
Union Oil Co.	34	5	11	Copeland 21	Huntington Beach
Utacal Oil Trust	2	6	11	1-A	Huntington Beach
SAN MATEO COUNTY:					
Big Basin Paraffin Oil Co.	10	8	3	1	-----
Elk Hills Pool Oil Co.	M. U.	Souza	Ranch	1	-----
SANTA CLARA COUNTY:					
Santa Clara Oil Co.	1	12	3	1	-----
SONOMA COUNTY:					
Alexander Valley Oil Co.	--	10	9	1	-----
TULARE COUNTY:					
Dun Mar Oil Co.	Lot 434	23	23	1	-----
Geo. F. King	Home Ex. Col.	22	27	1	-----
VENTURA COUNTY:					
Dr. J. Von Gal Scale	4	1	20	13	Concjo
Eureka Canon Petroleum Co.	33	4	18	1	Piru
Schell & Jennings	32	4	18	6	Piru
Lincoln Oil & Gas Co.	21	4	21	27	Santa Paula
Santa Paula Oil Co.	18	3	20	Santa Paula 18	South Mountain
Associated Oil Co.	19	3	23	Taylor 1-A	Ventura
YOLO COUNTY:					
Swastika Oil Co.	22	12	3	1	-----

From June 9, 1923, to and including September 8, 1923, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
FRESNO COUNTY:					
Snowolene Oil Co.-----	22	21	15	1	-----
KERN COUNTY:					
Bear State Oil Co.-----	30	28	21	11	Belridge
Pacific Oil Co.-----	25	30	24	49	Elk Hills
Pan American Petroleum Co.-----	2	31	24	Crampton 8-G	Elk Hills
Pan American Petroleum Co.-----	1	31	23		Elk Hills
Pan American Petroleum Co.-----	1	31	23		Elk Hills
Nova Kern Petroleum Co.-----	6	29	28		Kern River
McKittrick Chief Oil Co.-----	29	30	22	1	McKittrick
Big Ten Oil Co.-----	36	32	23	3	Midway
C. C. M. O. Co.-----	9	32	23	31	Midway
C. C. M. O. Co.-----	22	31	22	31	Midway
C. C. M. O. Co.-----	25	31	22	23	Midway
C. C. M. O. Co.-----	22	31	22	30	Midway
C. C. M. O. Co.-----	9	32	23	39	Midway
C. C. M. O. Co.-----	22	31	22	29	Midway
Formax Oil Co.-----	36	32	23	7	Midway
Formax Oil Co.-----	36	32	23	8	Midway
Honolulu Consolidated Oil Co.-----	6	32	24	38	Midway
Honolulu Consolidated Oil Co.-----	6	32	24	48	Midway
Mascot Oil Co.-----	36	32	23	2	Midway
Midland Oilfields Co., Ltd.-----	24	31	23	4	Midway
North American Oil Cons.-----	30	31	24	3	Midway
North American Oil Cons.-----	30	31	24	4	Midway
Pacific Oil Co.-----	31	31	24	26	Midway
Pacific Oil Co.-----	35	31	23	81	Midway
Pacific Oil Co.-----	31	31	24	36	Midway
Pacific Oil Co.-----	1	32	23	105	Midway
Pacific Oil Co.-----	31	31	24	33	Midway
Pacific Oil Co.-----	5	32	24	41	Midway
Pacific Oil Co.-----	25	31	23	34	Midway
Pinal Dome Crp.-----	24	31	22	Coalinga-Mont. 4	Midway
Surpriss Oil Co.-----	36	32	23		Midway
Vivian B. Oil Co.-----	35	32	23	4	Midway
Calitroleum Oil & Gas Co.-----	4	11	23	3	Sunset
General Petroleum Corp.-----	32	12	23	9-A	Sunset
Pinal Dome Corp.-----	20	29	21	Miller & Lux 1	Tembler
General Petroleum Corp.-----	28	11	20		Wheeler Ridge
C. S. Akers-----	18	27	19		-----
Fresno Sunmaid Oil Co.-----	16	11	24	1	-----
T. A. Piper-----	11	27	28	Piper 1	-----
KINGS COUNTY:					
Pacific Oil and Gas Co.-----	13	23	20	3	-----
LOS ANGELES COUNTY:					
Acme Petroleum Corp.-----	19	4	12	Damron 3	Long Beach
B. C. & L. Oil Co.-----	24	4	13	Herwick 12	Long Beach
Bartholomae Oil Corp.-----	19	4	12	Tom Johnson 1	Long Beach
Bemco Oil Syn. No. 1-----	24	4	13		Long Beach
Big 3 Oil Co.-----	24	4	13	1-A	Long Beach
Black Gold Royalties-----	24	4	13	1	Long Beach
Bolan & McNeice-----	19	4	12	1	Long Beach
Bush Voorhis Oil Co.-----	19	4	12	12	Long Beach
California Signal Well No. 4-----	30	4	12	1	Long Beach
Cooper Petroleum Co.-----	19	4	12	3	Long Beach
Dabney & Delaney-----	24	4	13	Natzke 1	Long Beach
Davis & McMillan Co.-----	29	4	12		Long Beach
J. J. Doyle & J. W. Clune-----	29	4	12	2	Long Beach
Ford and Eves Syn.-----	20	4	12	1	Long Beach
Fred B. Foster & Co.-----	30	4	12	65	Long Beach
General Petroleum Corp.-----	30	4	12	Jonah 3	Long Beach
General Petroleum Corp.-----	20	4	12		Long Beach
Golaspy Drilling Co.-----	29	4	12	2-A	Long Beach
H. C. & S. Oil Co.-----	24	4	13	1	Long Beach
Hackworth & Brunwin-----	24	4	13	Cullan Landis 1	Long Beach
Hall-Weber Oil Co.-----	29	4	12		Long Beach
Havenstrite & Baker-----	19	4	12	2	Long Beach
Herwick No. 7 Syn.-----	24	4	13	11	Long Beach
Hub Oil Co.-----	24	4	13	Beck 2	Long Beach
Hub Oil Co.-----	24	4	13		Long Beach
R. E. Ibbetson-----	19	4	12	Security 1	Long Beach
Interstate Oil Corp.-----	19	4	12		Long Beach
Interstate Oil Corp.-----	19	4	12	Peck 1	Long Beach
A. T. Jergins Trust-----	19	4	12	Olson 2	Long Beach
O. D. Knight et al.-----	19	4	12		Long Beach
Lacal Oil Co.-----	29	4	12	8	Long Beach
Lang-Wall-----	24	4	13	2	Long Beach

Company	Sec.	Twsp.	Range	Well No.	Field
LOS ANGELES CO.—Cont.					
M. K. M. Syn.	19	4	12	1	Long Beach
Malin No. 1, Trust No. 509	19	4	12	1	Long Beach
Marine Oil Corp.	19	4	12	13-A	Long Beach
Marine Oil Corp.	20	4	12	10	Long Beach
Marine Oil Corp.	19	4	12	23	Long Beach
E. J. Miley	13	4	13	3-A	Long Beach
Harry C. Noonan & Co.	30	4	12	1	Long Beach
Painted Hills Oil Assn.	29	4	12	5	Long Beach
Pan American Petroleum Co.	19	4	12	4UP	Long Beach
Pan American Petroleum Co.	29	4	12	Anderson 3	Long Beach
Pan American Petroleum Co.	29	4	12	Stone 1	Long Beach
E. A. Parkford	19	4	12	Betz 2	Long Beach
H. H. Patton	19	4	12	1	Long Beach
Pentagon Oil Co.	24	4	13	4	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Gray 2	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Foster Two 1	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Foster Two 2	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Foster One 2	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Walker 1-A	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Fields 3-A	Long Beach
Petroleum Midway Co., Ltd.	29	4	12	Perrin 1-A	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Fields 4	Long Beach
Petroleum Midway Co., Ltd.	19	4	12	Fields 6	Long Beach
W. R. Ramsey	29	4	12	2-A	Long Beach
W. R. Ramsey	29	4	12	2-B	Long Beach
Rogers & Edwards	19	4	12	1	Long Beach
San Martinez Oil Co.	29	4	12	Booth Com. 2	Long Beach
Shell Co.	29	4	12	Alamitos 8	Long Beach
Shell Co.	29	4	12	Coseboom 4	Long Beach
Shell Co.	29	4	12	Coseboom 3	Long Beach
Shell Co.	20	4	12	Andrews 5	Long Beach
Shell Co.	19	4	12	Cresson Com. 5	Long Beach
Shell Co.	29	4	12	Alamitos 11	Long Beach
Shell Co.	29	4	12	Hutton Com. 5	Long Beach
Shell Co.	29	4	12	Nesa 5	Long Beach
Shell Co.	29	4	12	Alamitos 9	Long Beach
Shell Co.	19	4	12	Cresson Com. 6	Long Beach
Shell Co.	29	4	12	Binkley Com. 2	Long Beach
Shell Co.	29	4	12	Alamitos 10	Long Beach
Shell Co.	29	4	12	Patton Wilson 2-A	Long Beach
Shell Co.	29	4	12	Jones Com. 5	Long Beach
Shell Co.	29	4	12	Goddard 4	Long Beach
Shell Co.	29	4	12	Cherry Hill Com. 5	Long Beach
Shell Co.	29	4	12	Stratton 2	Long Beach
Shell Co.	29	4	12	Shell Fee Land 2	Long Beach
Shell Co.	29	4	12	Pickler 6	Long Beach
Shell Co.	29	4	12	Shell Fee Land 3	Long Beach
Shell Co.	29	4	12	Hamilton 2	Long Beach
Silverado Oil Co.	23	4	13	1	Long Beach
Special Delivery Oil Syn.	24	4	13	A	Long Beach
Special Delivery Oil Syn.	24	4	13	3-B	Long Beach
Superior Oil Co.	29	4	12	Miller 2	Long Beach
Jos. K. Tobin	24	4	13	2	Long Beach
Jos. K. Tobin	19	4	12	2	Long Beach
Clarence M. Turner Syn.	24	4	13	2	Long Beach
The United Oil Co.	19	4	12	Hass 8	Long Beach
The United Oil Co.	30	4	12	Hass 7	Long Beach
The United Oil Co.	19	4	12	Hass 9	Long Beach
United States Royalties Co.	24	4	13	7	Long Beach
The Virginian, Inc.	24	4	13	1	Long Beach
R. Whiston	24	4	13	2	Long Beach
Whittier Kent & Hellman	19	4	12	King Tut 1	Long Beach
Standard Oil Co.	1	2	12	Baldwin 62	Montebello
Amalgamated Oil Co.	6	3	11	Dewenter 4	Santa Fe Springs
Amalgamated Oil Co.	31	2	11	Dalluggee 6	Santa Fe Springs
Amazon Drilling Co.	6	3	11	Fulton 1	Santa Fe Springs
Amazon Drilling Co.	6	3	11	Fulton 2	Santa Fe Springs
Ambassador Oil Co.	5	3	11	Baker 5	Santa Fe Springs
Associated Oil Co.	1	3	12	Clarke 8	Santa Fe Springs
Associated Oil Co.	1	3	12	Clarke 5	Santa Fe Springs
Chas. B. Behr Oil Syn.	1	3	12	1	Santa Fe Springs
Elmer J. Boeske, Jr.	1	3	12	6	Santa Fe Springs
Buckeye Union Oil Co.	5	3	11	5	Santa Fe Springs
Buckeye Union Oil Co.	5	3	11	6	Santa Fe Springs
Burbank Oil Co.	26	2	12	Crittenden 1	Santa Fe Springs
Commercial Refining Co.	1	3	12	1	Santa Fe Springs
Empire Drilling Co.	36	2	12	1	Santa Fe Springs
Fisher Gregg Oil Syn.	1	3	12	1	Santa Fe Springs
General Petroleum Corp.	6	3	11	Santa Fe 85-A	Santa Fe Springs
General Petroleum Corp.	6	3	11	Jalk 9	Santa Fe Springs
General Petroleum Corp.	5	3	11	Santa Fe 16	Santa Fe Springs
General Petroleum Corp.	5	3	11	Santa Fe 15	Santa Fe Springs
George F. Getty	5	3	11	S. F. S. 16	Santa Fe Springs

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES CO.—Cont.					
George F. Getty	5	3	11	S. F. S. 17	Santa Fe Springs
George F. Getty	6	3	11	S. F. S. 15	Santa Fe Springs
Globe Petroleum Corp.	1	3	12	de l'Eau 1	Santa Fe Springs
Oscar R. Howard	5	3	11	Bell 3	Santa Fe Springs
Oscar R. Howard	6	3	11	Hathaway 4	Santa Fe Springs
Oscar R. Howard	6	3	11	Hathaway 5	Santa Fe Springs
Industrial Oil Syn. No. 3	6	3	11	32	Santa Fe Springs
Interstate Petroleum Syn. No. 1	35	2	12	1	Santa Fe Springs
Jameson Petroleum Co.	6	3	11	7	Santa Fe Springs
Laddie Boy Oil Co.	1	3	12	1	Santa Fe Springs
Frank Peterson Syn.	6	3	11	2	Santa Fe Springs
Petroleum Midway Co., Ltd.	6	3	11	Mattern Two 6	Santa Fe Springs
Petroleum Midway Co., Ltd.	6	3	11	Steinly 3	Santa Fe Springs
Petroleum Midway Co., Ltd.	31	2	11	Mattern One 2	Santa Fe Springs
Santa Fe Springs Oil Syn. No. 1	6	3	11	4	Santa Fe Springs
Santa Fe Springs Oil Syn. No. 2	6	3	11	3	Santa Fe Springs
Shell Co.	6	3	11	Slusher 8	Santa Fe Springs
Shell Co.	6	3	11	Slusher 5	Santa Fe Springs
Shell Co.	31	2	11	G.H.N. 9	Santa Fe Springs
Shell Co.	31	2	11	G.H.N. 10	Santa Fe Springs
Shell Co.	31	2	11	Thompson 3	Santa Fe Springs
Shell Co.	31	2	11	G.H.N. 11	Santa Fe Springs
Shell Co.	31	2	11	G.H.N. 7	Santa Fe Springs
Shell Co.	6	3	11	Slusher 6	Santa Fe Springs
Shell Co.	6	3	11	Slusher 9	Santa Fe Springs
Shell Co.	6	3	11	Slusher 11	Santa Fe Springs
Shell Co.	6	3	11	Slusher 10	Santa Fe Springs
Shell Co.	6	3	11	Slusher 7	Santa Fe Springs
Southern California Oil Co.	6	3	11	2	Santa Fe Springs
Standard Oil Co.	31	2	11	Santa Gertrudes 5	Santa Fe Springs
Standard Oil Co.	36	2	12	Houghton 1	Santa Fe Springs
Standard Oil Co.	6	3	11	Jordan 2	Santa Fe Springs
Standard Oil Co.	6	3	11	Weisel 7	Santa Fe Springs
Standard Oil Co.	5	3	11	S. Whittier Com. 18	Santa Fe Springs
Standard Oil Co.	6	3	11	Koontz 5	Santa Fe Springs
Standard Oil Co.	5	3	11	S. Whittier Com. 17	Santa Fe Springs
Standard Oil Co.	6	3	11	Jordan 4	Santa Fe Springs
Standard Oil Co.	31	2	11	Santa Gertrudes 6	Santa Fe Springs
Standard Oil Co.	6	3	11	Weisel 8	Santa Fe Springs
Standard Oil Co.	6	3	11	Walker 10	Santa Fe Springs
Standard Oil Co.	31	2	11	Hepler 5	Santa Fe Springs
Standard Oil Co.	6	3	11	Koontz 6	Santa Fe Springs
Tri-Color Oil Co.	35	2	12	1	Santa Fe Springs
Union Oil Co.	5	3	11	Farwell 10	Santa Fe Springs
Universal Cons. Oil Co.	6	3	11	5	Santa Fe Springs
Wilshire Oil Co.	8	3	11	Meyer 2	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Baker 1	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Baker 2	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Fraser 4	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Fraser 6	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Fraser 5	Santa Fe Springs
Wilshire Oil Co.	6	3	11	Baker 3	Santa Fe Springs
C. C. M. O. Co.	10	4	14	Torrance 12	Torrance
C. C. M. O. Co.	10	4	14	Torrance 17	Torrance
C. C. M. O. Co.	14	4	14	Torrance 14	Torrance
C. C. M. O. Co.	15	4	14	Torrance 13	Torrance
C. C. M. O. Co.	15	4	14	Torrance 15	Torrance
C. C. M. O. Co.	14	4	14	Torrance 16	Torrance
C. C. M. O. Co.	14	4	14	Torrance 18	Torrance
C. C. M. O. Co.	9	4	14	Del Amo 8	Torrance
Federal Drilling Co.	23	4	14	Gerner 1	Torrance
Federal Drilling Co.	23	4	14	Heyman 1	Torrance
Fortuna Oil Co.	23	4	14	1	Torrance
Geo. F. Getty	14	4	14	Torrance 3	Torrance
Gilmore Oil Co.	15	4	14	Davidson-Lowe 1	Torrance
Hub Oil Co.	14	4	14	B. & C. 1	Torrance
Petroleum Midway Co., Ltd.	14	4	14	Post-Houts 1	Torrance
Petroleum Midway Co., Ltd.	9	4	14	Craven Com. 1	Torrance
Petroleum Midway Co., Ltd.	8	4	14	Gish 2	Torrance
Petroleum Midway Co., Ltd.	15	4	14	Wilson Com. 1	Torrance
Petroleum Midway Co., Ltd.	10	4	14	Bowers 1	Torrance
Petroleum Midway Co., Ltd.	10	4	14	Scott 1	Torrance
Petroleum Midway Co., Ltd.	14	4	14	Pickler-Mitchell 1	Torrance
Petroleum Securities Co.	15	4	14	1	Torrance
Security Oil Syn. No. 2	23	4	14	1	Torrance
Selby and Root Co.	15	4	14	1	Torrance
Sentinel Oil Co.	24	4	14	1	Torrance
Southern Midway Oil Co.	10	4	14	1	Torrance
Standard Oil Co.	10	4	14	Torrance Com. 4	Torrance
Standard Oil Co.	8	4	14	Kirk Com. 4	Torrance
Standard Oil Co.	13	4	14	Dominguez 1	Torrance
Superior Oil Co.	14	4	14	Sterry 1	Torrance
Superior Oil Co.	10	4	14	Bowles 1	Torrance

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES CO.—Cont.					
Superior Oil Co.-----	10	4	14	Hookway 1	Torrance
Superior Oil Co.-----	14	4	14	Steinhilber 2	Torrance
Superior Oil Co.-----	14	4	14	Steinhilber 1	Torrance
Superior Oil Co.-----	24	4	14	Joughin 1	Torrance
Universal Consolidated Oil Co.-----	23	4	14	Moore 1	Torrance
Downey Oil Syn.-----	4	3	12		-----
George F. Getty-----	28	3	13	Compton 1	-----
Julian Petroleum Corp.-----	25	3	12	Okell 1	-----
Pan American Petroleum Co.-----	2	3	15	Pac. Southwest 1	-----
Southland Petroleum Co.-----	9	2	15		-----
Union Oil Co.-----	29	3	11	Gardena 1	-----
Union Oil Co.-----	19	3	11	Rosecrans 1	-----
Union Oil Co.-----	33	3	13	Callender 3	-----
Wilshire Oil Co.-----	18	2	12	Arcadia 1	-----
MONTEREY COUNTY:					
Monterey Peninsular Oil Co.-----	8 miles	E. of Monterey		1	-----
ORANGE COUNTY:					
Union Oil Co.-----	19	3	9	Tuffree 1	Coyote Hills
C. R. J. Oil Co.-----	6	6	10	Lamb 1	Huntington Beach
Chicksan Oil Co.-----	35	5	11		Huntington Beach
George F. Getty-----	2	6	11		Huntington Beach
Holly Development Co.-----	2	6	11	Turley 5	Huntington Beach
Holly Oil Co.-----	35	5	11		Huntington Beach
Julian Petroleum Corp.-----	34	5	11	Texcal 3	Huntington Beach
Leonard & Porter-----	2	6	11		Huntington Beach
Miley Keck Oil Co.-----	2	6	11		Huntington Beach
Miley Keck Oil Co.-----	2	6	11		Huntington Beach
Petroleum Midway Co., Ltd.-----	11	6	11	Taylor 1	Huntington Beach
Petroleum Midway Co., Ltd.-----	11	6	11	Brown 2	Huntington Beach
Petroleum Midway Co., Ltd.-----	35	5	11	Savage 3	Huntington Beach
Petroleum Midway Co., Ltd.-----	2	6	11	Ray Walker 1-A	Huntington Beach
Republic Prod. Co.-----	2	6	11	Kirk 8	Huntington Beach
Selby and Root Co.-----	34	5	11	Curtis 2-A	Huntington Beach
Standard Oil Co.-----	14	6	11	Mills 2	Huntington Beach
Standard Oil Co.-----	3	6	11	Hunt. A. 22	Huntington Beach
Standard Oil Co.-----	3	6	11	Hunt. A. 21	Huntington Beach
Standard Oil Co.-----	11	6	11	Talbert Com. 2	Huntington Beach
Standard Oil Co.-----	2	6	11	Hunt. D. 5	Huntington Beach
Texas Holding Co.-----	2	6	11		Huntington Beach
Newport Oil & Refining Co.-----	28	6	10	Newport 1	Newport
Petroleum Midway Co., Ltd.-----	34	3	9	Richfield Cons. 8	Richfield
Standard Oil Co.-----	13	4	10	Wagner Com. 1	-----
RIVERSIDE COUNTY:					
Murietta Valley Oil Co., a trust-----	14	7	3	1	-----
SACRAMENTO COUNTY:					
Associated Development Co.-----	25	6	7	Mitchell 2	-----
SAN JOAQUIN COUNTY:					
Alliance Oil Co.-----	7	4	8	1	-----
SAN MATEO COUNTY:					
Unity Oil Co.-----	Driver Ranch, San Gregorio Rancho			1	-----
SONOMA COUNTY:					
Skaggs Springs Oil & Gas Co., Inc.-----	24	10	11	1	-----
Skaggs Springs Oil & Gas Co., Inc.-----	24	10	11	2	-----
STANISLAUS COUNTY:					
Stanislaus County Oil Syn.-----	14	6	7	1	-----
VENTURA COUNTY:					
Chas. E. Clinton-----	14	1	20	1	Conejo
A. H. MacFarland-----	33	4	18	1	Piru
Schell & Jennings-----	32	4	18	7	Piru
Sam O'Conner-----	20	5	19	1	Sespe
Santa Paula Oil Co.-----	18	3	20	Santa Paula 14	South Mountain
South Slope Oil Co.-----	23	3	21		South Mountain
Associated Oil Co.-----	27	3	23	Lloyd 8	Ventura

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

CLAY DEPOSITS OF THE ALBERHILL COAL AND CLAY COMPANY.

By JAS. H. HILL.¹

Location.

The clay deposits of the Alberhill Coal and Clay Company, comprising some two thousand acres of land, are situated at the town of Alberhill, in Riverside County, California, approximately seventy-five miles southeast of Los Angeles. Reference to the accompanying map, Plate 1, will indicate the region directly served by them, and their central location with respect to the many important towns and cities of this district.

The great economic importance of these deposits may be considered to be due to three main factors:

(1) The excellent quality, wide variety, and enormous quantities of the clays available.

(2) The extensive commercial development of the deposits over many years, resulting in cheapness of mining and large-scale production.

(3) The fortunate central location in a densely populated and rapidly growing section.

The portion of southern California served from these deposits has for several years shown an almost unprecedented growth in wealth, population, and commercial development, with a resulting demand for clay products of all kinds far in excess of the ability of local manufacturers to supply. Clay working plants have continually increased their capacities, and many new ones have sprung up in response to the insatiable demand for building materials and pottery wares of all sorts, so that the Los Angeles district is now one of the great clay-working centers of the United States. A great preponderance of the raw material for these plants has been supplied by the Alberhill deposits, owing to their natural advantages in quality of clays and cheap quantity production.

¹President, Alberhill Coal and Clay Company.



Plate 1. Location of the Alberhill Coal and Clay Company's Deposits at Alberhill, California.

The occurrence of the Alberhill clays is uniquely favorable, since the deposits comprise an entire small mountain or detached foothill some five miles in circumference, rising abruptly from the floor of the Temescal Valley. The tracks of the Atchison, Topeka, and Santa Fe Railway skirt the base of this hill, closely adjacent to the clay pits themselves, so that the clay may proceed by gravity haulage direct to loading trestles over the rails. Further advantage of the elevation of the clays above the rails has been taken in the mining processes, as will be noted later, with the result that large tonnages are handled at a minimum cost.

General Geology.

"The valley in which these extensive deposits lie was in Tertiary times an arm of the sea opening northward into the valley of western San Bernardino County and extending southerly to Temecula. Its width is from one to two miles, but its depth is unknown, as at the old terra cotta works near Alberhill a drill hole was sunk over 600 feet without reaching the bottom of the basin."¹

At the Alberhill pits, the clays present a wide diversity of color, character, and degree of consolidation. An extraordinary variety is found, including silicious fire clays, ball clays, plastic white- and buff-burning clays, highly aluminous and very refractory clays, numerous red-burning clays, and an extensive bed of material from which a china clay is obtained by washing. A bed of lignite coal ranging from two to eleven feet in thickness occurs conformably with the clay strata, and adjacent to this the best fire clays are found. The strata are regular

¹'Clay Industry in California,' Preliminary Report No. 7, January, 1920, California State Mining Bureau.

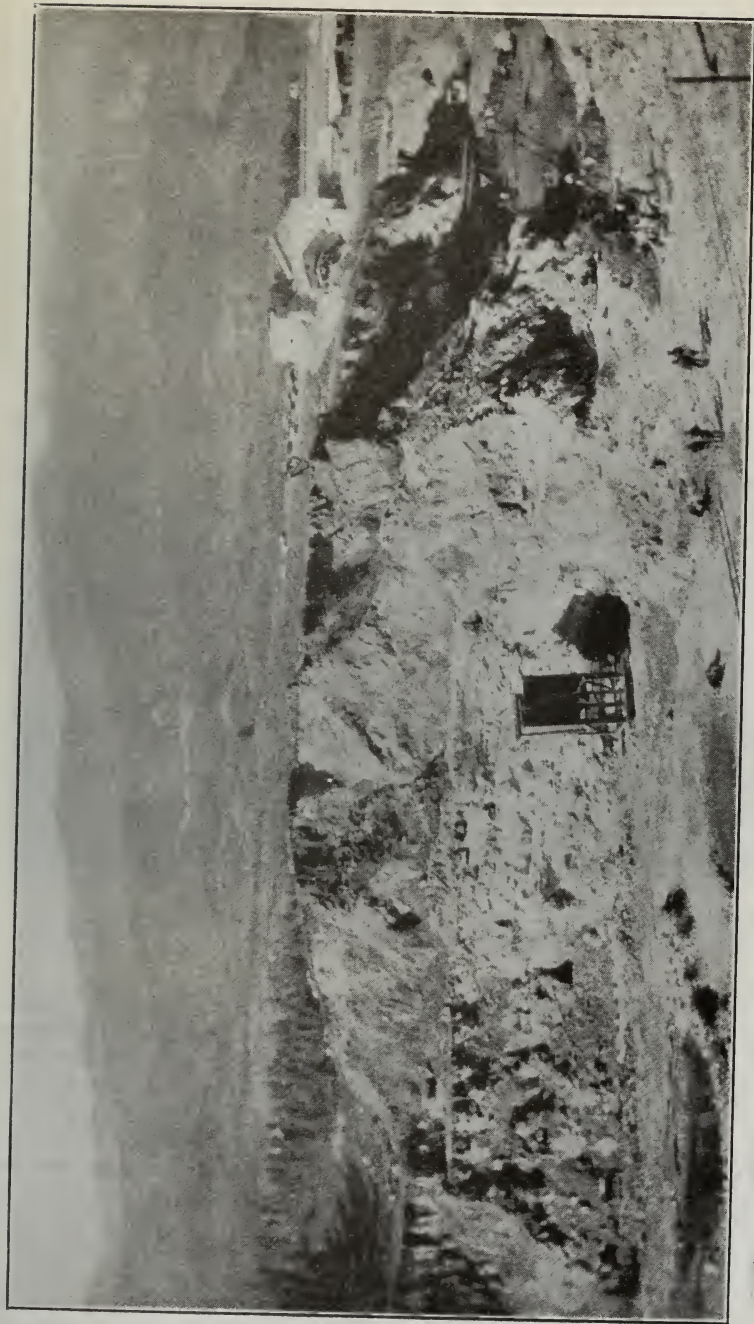


Photo No. 1. Southwest wall of the Main Pit of the Alberhill Coal and Clay Company. The heavy stratum of clay directly behind the bunker is Main Tunnel Fire Clay. In the background, Plant No. 4 of the Los Angeles Pressed Brick Company, which draws clay direct from the Alberhill pits.

and persistent, and dip to the southwest with an average value of 10 degrees, with local variations due to an undulatory or wavy folding.

Minor local disturbances appear to have prevailed at intervals during deposition of these clays, and coarse sandy beds are interspersed with fine-grained plastic clays. In these sandy beds, the coarse silica sand is often intermixed in a sporadic and irregular fashion with the accompanying clay substance. Mottled clays apparently due to simultaneous deposition of different kinds of sediments derived from separate sources are also found. The beds in general seem to indicate that long quiescent periods during which fine grained clays were laid down were preceded and followed by stormy periods when frequent freshets or strong tidal currents brought in coarse silica sand and granitic debris from surrounding highlands. The top soils of the region consist of debris of disintegrated granite, and vary from a few inches to many feet in thickness.



Photo No. 2. Looking into the Main Pit of the Alberhill Coal and Clay Company from the West Pit. The pit walls here shown range up to sixty feet or more in height, all clay.

Extent and Commercial Development.

Owing to the masking of the surface by the layer of disintegrated granitic material, the total extent of the Alberhill deposit has not yet been fully determined. However, a large number of bore holes have been put down on widely separated portions of the property, and in every case clays of good quality were found to the full extent of the hole in depth. From this and other evidence, it seems quite probable that the entire mass of the small mountain, above the valley floor and for an unknown depth below, is clay. A few isolated occurrences of shale have been noted. Exploration to date has been sufficient to indicate beyond doubt that the quantity of readily available clay is so vast as to be inexhaustible for all practical purposes, and this fact, in combination with the good quality of the clays, makes the deposit one of great commercial importance. The hill comprising the deposit is about two and one-quarter miles long and one mile in width, with an average

elevation of 1680 feet. The main line tracks of the railway skirting the hill are at an elevation of about 1277 feet, so that the enormous tonnages awaiting development by simple gravity processes are evident. The present pits are all somewhat above the level of the railroad tracks.

Up to the year 1895 the Alberhill Coal and Clay Company operated the property principally as a coal mine, extracting and marketing the lignite coal previously mentioned as occurring with the clays. From that year onward, however, the sales of clay rapidly increased, and very soon completely overshadowed the coal in importance. At the present time the coal is mined only for local and special uses, but there is a large tonnage available and merely awaiting modern practice in the way of distillation or use as powdered fuel.

A small trainload of clay leaves the Alberhill pits each working day for distribution to the southern California clay-working plants, and the production for the year 1922 reached a total of approximately 2500 car-

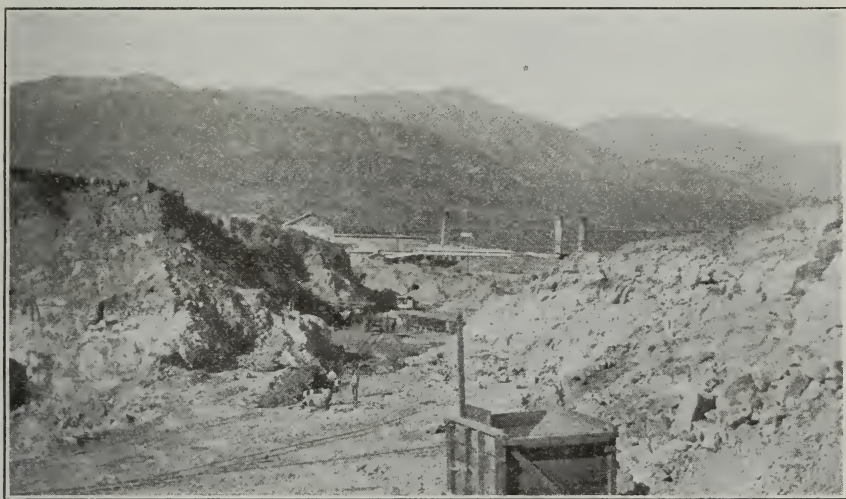


Photo No. 3. Notch connecting Main and West Pits, Alberhill Coal and Clay Company. Plant No. 4 of the Los Angeles Pressed Brick Company in the background.

loads. The clays enter into the manufacture of a great diversity of products, ranging from china to coarse wares such as sewer pipe and hollow tile. The production of high grade face brick made from these clays reaches very large proportions, and these may be seen in numerous buildings throughout the towns of southern California, and to some extent in neighboring states. Fire brick and refractories to the number of several millions annually are made from the fire clays supplied by the company. It is probable that these two lines account for the greater part of the total tonnage produced. A large modern plant which draws its clays direct from the Alberhill pits is operated at Alberhill by the Los Angeles Pressed Brick Company, and it seems probable that the commercial advantages of a location directly at the source of raw material will result in bringing additional plants in future. At present most of the plants to which clay is supplied are located in the Los Angeles industrial districts.

Among manufactured products for which Alberhill clays have been extensively used in recent years may be mentioned the following:

Fire brick	Flue lining
Special refractories	Yellow bowls
Electric furnace refractories	Floor tile
Face brick	Faience tile
Pressed brick	Art tile
Enameled brick	Hollow tile
Architectural terra cotta	Roofing tile
Garden terra cotta	Sewer pipe
Art pottery	Stoneware
Chinaware	Chemical stoneware
Electrical conduit	Saggers
Drain tile	

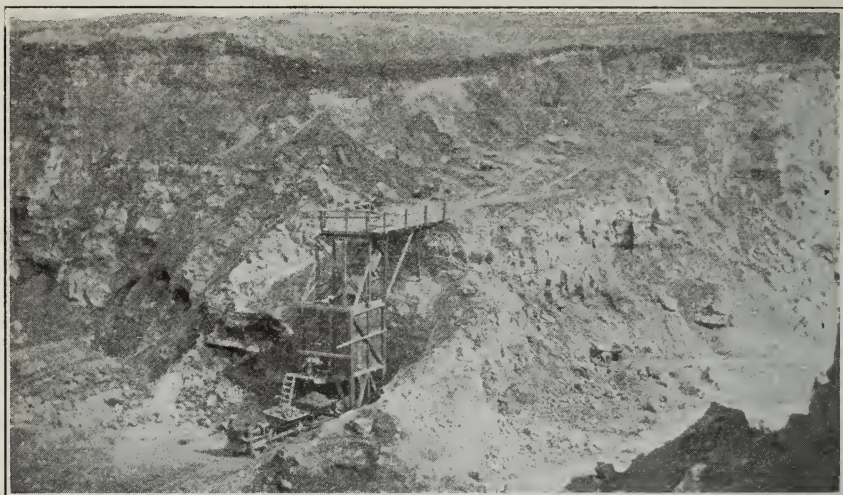


Photo No. 4. Stripping operations at the junction of the Main and West Pits, Alberhill Coal and Clay Company.

The Alberhill deposit, by reason of its operation over many years and the large production now attained, has undergone an extensive commercial development. Several pits are actively worked, of which the Main Pit and the West Pit are the most important. These pits have furnished thousands of carloads of clay, and are now very large excavations, though merely insignificant nicks in one flank of the hill when compared with its total bulk. Several tunnels have been driven into the deposit, the "West Tunnel" having a length of over 1000 feet in its main extent, with many side branches and feeders leading off at intervals. This tunnel is of large bore, heavily timbered, and electric lighted and equipped with mine tracks throughout for transfer of two-ton cars. No surface waters are permitted to enter, so that the tunnel remains dry and workable the year round. For general production purposes a complete equipment of tracks, mine cars, gasoline locomotives, trucks, wagons, mining machinery and tools, blacksmith shop, machine shop, bunk houses, workmen's and foremen's cottages, board-



Photo No. 5. Making up the daily clay train at Alberhill, from the Clay Mines of the Alberhill Coal and Clay Company.

ing house, water supply plant, and general store is maintained by the company. Extensive plans for the future of the town of Alberhill are under way, looking toward its development into a model industrial community. Trees are being planted, and the townsite graded and leveled by filling hollows and ravines with the stripping produced in the mining operations, preparatory to the laying out of a carefully landscaped industrial town by architects competent to make the best of its natural features, both for beauty and utility. The general plan of the company is that the community shall not be permitted to develop in a haphazard and unsightly way, and that it shall ultimately constitute an industrial town pleasant both to live in and to work in. Large



Photo No. 6. One of the loading trestles, Alberhill Coal and Clay Company.



Photo No. 7. Looking into the Main Pit of the Alberhill Coal and Clay Company. Upper West Pit workings visible at extreme upper left.



Photo No. 8. Upper West Pit workings of the Alberhill Coal and Clay Company. This entire region is honey-combed with glory holes extending down to the West Tunnel and its off-shoots, 30 to 60 feet below.

parcels of favorably located land have been set aside as plant sites for future clay industries, and a nine-hole golf course has been completed and is maintained for the use of employees and the public generally.

Methods of Mining.

The general method of mining the Alberhill clays is by the usual open-pit workings. The clays are, for the most part, rather densely compacted and stand well in vertical banks. The faces of these banks are blasted down and the clay loaded into two-ton steel mine cars or trucks, to proceed directly to adjacent loading trestles over the switch lines entering the pits from the main tracks. Clays from the higher levels are shot down chutes into elevated bunkers, where convenient or desirable, under which trucks or mine cars may be run, and loaded by opening a discharge gate.

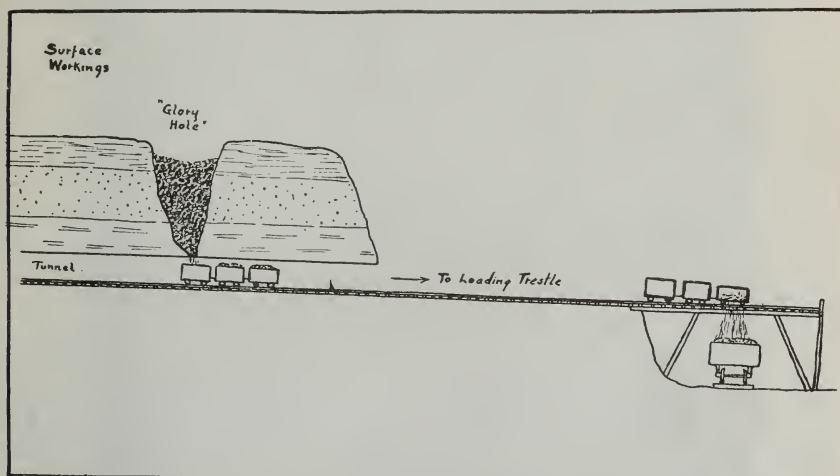


Plate 2. Handling and storage of clay by "glory hole" method.

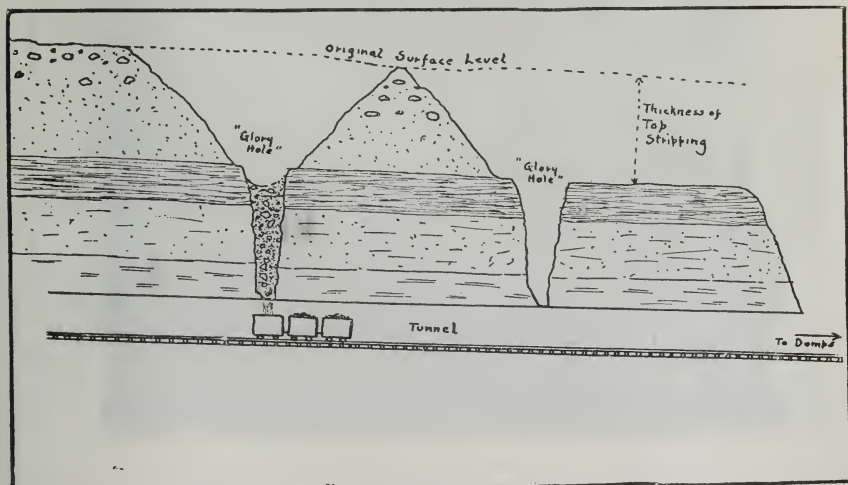


Plate 3. Stripping by glory hole and tunnel method.



Photo No. 9. Lower portion of the West Pit of the Alberhill Coal and Clay Company. Near the bunker is seen the mouth of the West Tunnel, which extends back under the upper workings to the West Pit for over 1000 feet, connecting to the surface by numerous glory holes for storing and handling the clay.

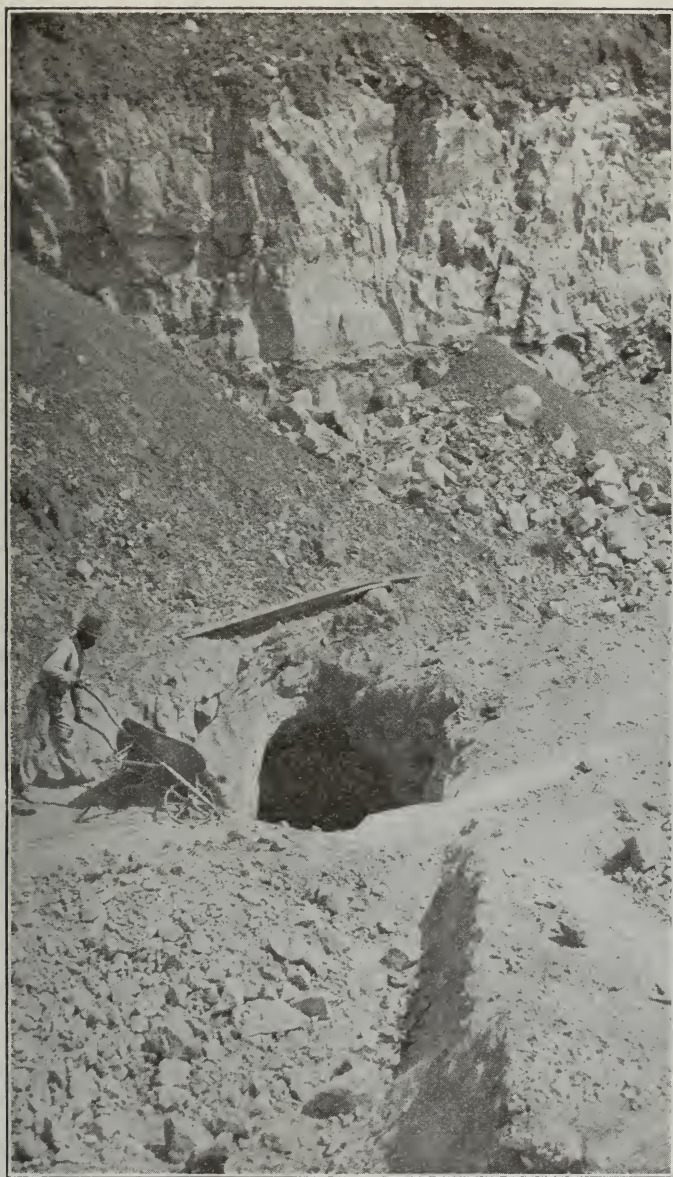


Photo No. 10. Upper West Pit of the Alberhill Coal and Clay Company. One of the glory holes connecting with the West Tunnel, 50 feet below the surface.

In the 'West Pit' region a variation of the ordinary methods is extensively employed, as indicated by the accompanying diagram. The entire upper portion of the 'West Pit' region is underlain by the 'West Tunnel' and its offshoots, the tunnel roughly paralleling the longitudinal extent of the surface workings, and being from 30 to 60 feet below them. Large 'glory holes' extend from the surface workings down to the tunnel at frequent intervals, their lower ends closed by gates or valves for controlling discharge of the clay. The clays are mined in the usual way in the open workings above, and dumped into adjacent glory holes from which they are drawn off into cars on the tunnel tracks below as needed, to proceed thence to the loading trestles in the usual way. This system has been found economical and convenient, especially so as each glory hole constitutes a storage bin for two carloads (100 tons) of clay or more. A similar system is sometimes employed for stripping the clay strata of top soils and granite debris, where tunnels have been driven beneath the area to be developed. (See accompanying diagram, Plate 3.) By this method a great funnel of the loosely compacted stripping can be very quickly cascaded down the glory hole, to be carried away to dumps by the mine cars which receive it on the tunnel tracks below.

In addition to the above processes, a considerable amount of underground work is always proceeding in conjunction with further development and extension of the tunnels themselves.

Geological Section of the Alberhill Deposit.

For convenience in discussing the different varieties of clays marketed, and as a means of indicating their geological horizon and method of occurrence, the accompanying geological section of the Alberhill deposit is given. This section is, of course, merely diagrammatic, and somewhat simplified to represent *average* or general conditions, since each locality shows small variations and departures from what may

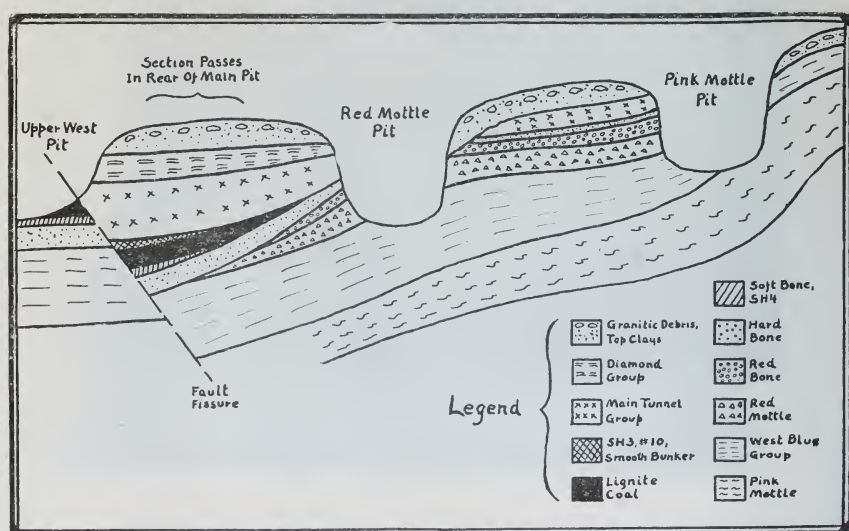


Plate 4. Diagrammatic section of strata at Alberhill, in a general west-east line.

be considered the normal. Certain clays may be much thicker bedded in one region than in another, and some grades of clay which constitute a characteristic variation of their stratum may be developed only in particular areas. The attempt has been, therefore, to present a diagrammatic representation of the complete sequence of beds, so that their relation may be grasped at a glance.



Photo No. 11. Stripping operations of the Alberhill Coal and Clay Company. Rear wall of Main Pit visible in background.

Each stratum or 'group' here shown represents as nearly as possible, a geological period during which the conditions of deposition were essentially uniform. The clays mined from any given stratum show a noticeable similarity in character and a relationship to each other, though they may be commercially graded into two or three varieties. On passing to another stratum or group, a pronounced change in the general character of the clay is noted. The fault, or slip, noted as

occurring near the east side of the 'West Pit' is not of great consequence, being only two or three hundred yards long and with a maximum down-throw of thirty feet or so. The continuation of any bed is readily picked up on crossing it.

Individual Clays.

More than thirty varieties and grades of clay are mined and marketed by the Alberhill Coal and Clay Company, among which those suited to almost any branch of the clay-working industry may be selected. There are, however, a number of these clays which, by reason of their wide usefulness and extensive commercial employment, are specially important. Brief notations regarding the character and uses of these clays follow. The clays are designated by the name under which marketed.

SH4 BALL CLAY.

This is a clean clay of very high plasticity, possessing great bonding or 'carrying' power in the plastic state. It has proven very useful in a great variety of mixes with less plastic grades, in the way of imparting improved color and working quality to the mix. SH4 clay is considerably more refractory than English ball clays, and burns to a much whiter color, approaching washed English China clay in this regard. It is not safe burning alone, but works excellently in proper combination with other clays, and has many valuable qualities. The accompanying analysis indicates its average composition:

<i>*Analysis of SH₄ Ball Clay.</i>		Per cent
Silica	-----	47.08
Alumina	-----	33.36
Iron oxide	-----	.96
Lime	-----	.66
Magnesia	-----	Trace
Sodium and potassium oxides	-----	.13
Moisture, 105 degrees C.	-----	3.98
Combined water and volatiles	-----	12.88
Titanium oxide	-----	1.38
Manganese oxide	-----	Trace
Chlorine	-----	None
Sulphuric anhydride	-----	None
Nitric anhydride	-----	None
Phosphoric anhydride	-----	None
		100.43

*Analysis by Smith Emery Company, Los Angeles, Cal. Some of the samples of this clay analyzed have shown a content of iron oxide up to 1.9 per cent, but in such cases the titanium seems always to run low, so that the total percentage of coloring matter remains approximately constant.

As mined, SH4 is dark gray in color, and a dry lump placed in water will flake down and disintegrate within less than one minute. The resulting flaky material, when worked and kneaded, becomes exceedingly plastic. This clay has been used in the manufacture of china, porcelain, refractories, pottery, and many other wares where a very plastic clay is needed to carry less plastic materials, and a good white color is particularly desired.

SH3 CLAY.

This is a white-burning clay locally developed directly over the lignite coal bed. It is light gray in color, breaks down readily in water, and works up to a condition of good plasticity, though it has not as great bending power as SH4. In burned color it is not quite so white as SH4, but it is much safer in drying and burning, and has considerably less shrinkage. It is fairly refractory in character, but burns to a strong body at very moderate heats. It might be mentioned here that all the Alberhill clays, even the red-burning varieties, possess an unusually long heat range, and are safe from over or under burning.

SH3 in proper combinations has proved excellent for the manufacture of faience tile, garden terra cotta, face brick, enameled brick, building terra cotta, saggers, and similar products. Recent experiments in washing the clay seem to indicate that its color may be sufficiently improved by this process to allow of its use in china and porcelain bodies in larger quantity than has heretofore been considered permissible. The following analysis indicates the general character of the clay as mined:

<i>*Analysis of SH3 Clay.</i>		Per cent
Silica	-----	63.00
Alumina	-----	23.83
Iron oxide	-----	1.28
Lime	-----	.76
Magnesium oxide	-----	None
Sodium and potassium oxides	-----	.56
Moisture, 105 degrees C.	-----	1.18
Combined water and volatiles	-----	8.68
Titanium oxide	-----	.89
Manganese oxide	-----	None
Chlorine	-----	None
Sulphuric anhydride	-----	None
Nitric anhydride	-----	None
Phosphoric anhydride	-----	Trace
		<hr/> 100.18

*Analysis by Smith Emery Company, Los Angeles, Cal.

No. 10 CLAY.

This clay somewhat resembles SH3 in general performance, and is suited for similar purposes. It carries a little more silica sand than SH3, and is also more carbonaceous, and generally not so densely compacted. The color of the raw clay is generally dark gray, due to carbonaceous matter. No. 10 clay has good plasticity, burns white or grayish white, is fairly refractory, and produces a strong body at moderate heats. It is a much safer clay than SH4, and has less shrinkage, but is not quite so white-burning.

No. 10 clay has been very extensively used in the manufacture of face brick, faience tile, terra cotta, and similar products. In composition it does not differ greatly from SH3, but generally shows a slightly higher proportion of silica as compared with alumina, and a higher percentage of volatiles due to the carbonaceous matter.

MAIN TUNNEL FIRE CLAY.

This clay is commercially one of the most important produced at Alberhill, in view of its very extensive use in the manufacture of fire brick and refractories generally. It occurs in enormous quantities, the bed being often twenty feet or more in thickness. In character it is a

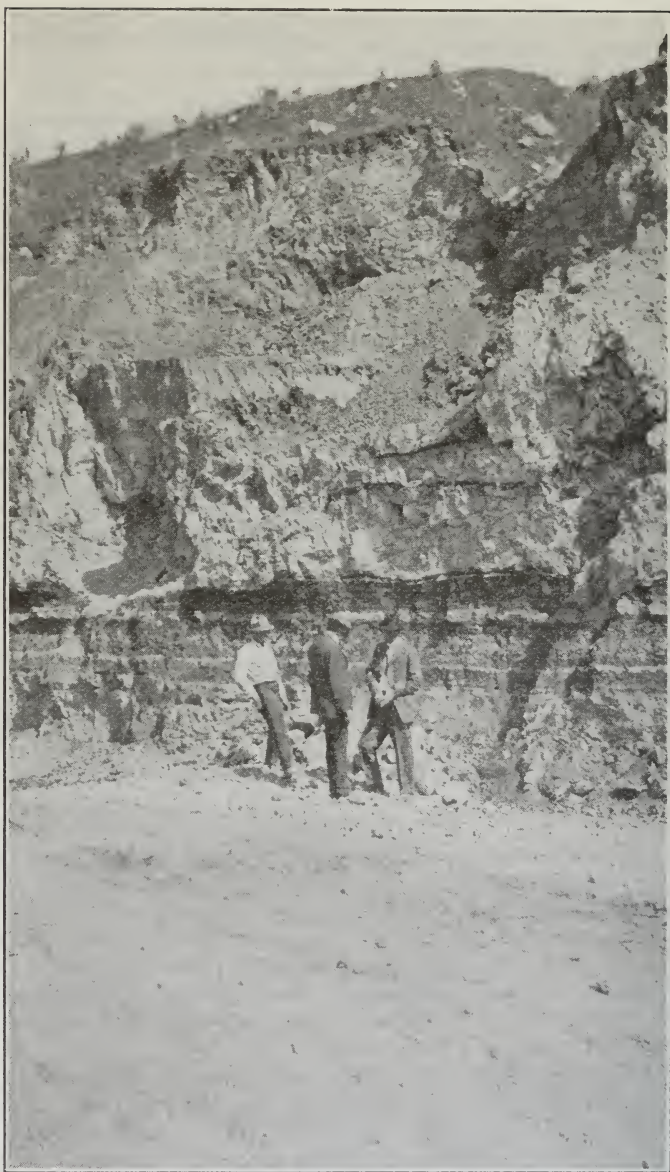


Photo No. 12. Clay mines of the Alberhill Coal and Clay Company. An exposure of the lignite coal. The clay stratum directly below the coal is SH4; that directly above is SH3 Clay.

siliceous fire clay and it is customarily graded into three varieties for marketing—'Main Tunnel,' 'Select Main Tunnel,' and 'Extra-Select Main Tunnel.' These varieties do not differ greatly in refractory quality, the grading being on the basis of the amount of coarse silica sand of which the 'Main Tunnel' carries a large amount, the 'Extra-Select' practically none. Analyses of the 'Main Tunnel' and 'Select Main Tunnel' grades are given below. The alumina-silica variation is due to the lesser proportion of coarse silica sand in the 'Select' grade, and a similar though much less marked difference exists between the 'Select' and 'Extra-Select.'

	'Main Tunnel' Clay Per cent	'Select Main Tunnel' Clay Per cent
Silica -----	75.46	59.44
Alumina -----	16.22	26.28
Iron oxide -----	2.24	2.24
Lime -----	.03	.26
Magnesia -----	Trace	.20
Alkalies -----	.20	.15
Ignition loss -----	6.24	11.64
	<hr/> 100.39	<hr/> 100.21

*Analysis by Smith Emery Company, Los Angeles, Cal.

The 'Main Tunnel' Fire Clays are gray in color, and quite dense and hard as mined, but break down readily in water and work up to a condition of good plasticity. They will carry a considerable proportion of grog where this is desirable, and possess a self-lubricating property that makes them work well from a die. In refractory qualities they have proved excellent, and several million fire brick and special refractories of one sort or another are made from them yearly in the Los Angeles district. These clays are all very safe in drying and burning, and find also a considerable field outside the line of refractories. The 'Select' grade is extensively used as a sagger clay, in combination with one or another of the red-burning clays mined at Alberhill, and such saggings are reported by a prominent eastern manufacturer to show about five times the life of his eastern saggings, under similar conditions.

SMOOTH BUNKER CLAY.

This is a white-burning clay carrying a considerable proportion of coarse silica sand. Owing to its low shrinkage and exceptionally safe drying and burning qualities, it has been rather extensively used for a wide variety of products, notably face brick and refractories, flue linings, and hollow tile mixes. Smooth Bunker has very fair plasticity, especially considering the amount of natural grog carried by it in the form of coarse silica sand, and it is readily workable. It breaks down in water without difficulty, and works up plastic at once.

'BONE CLAY.'

This clay shows an alumina content ranging up as high as 48 per cent in certain varieties, and is one of the most peculiar and unusual clays mined at Alberhill. It is being used at present for special purposes where its peculiar composition makes it of value, notably for the production of electrically fused refractories of the highest grade, and for high-alumina fire brick. It will probably be in much more general demand later, as its valuable qualities become better understood.



Photo No. 13. Rear wall of the Main Pit of the Alberhill Coal and Clay Company. Main Tunnel Fire Clay is being mined.

The 'Bone' clays occur in two varieties, 'Hard Bone' and 'Soft Bone.' The 'Soft Bone' occurs directly under the lignite coal in certain localities, and is a loosely compacted clay having an ashy appearance. It breaks down slowly in water, and has only a low degree of plasticity unless finely ground by some mechanical process, when a considerably increased plasticity is developed. The Soft Bone appears to run somewhat higher than the Hard Bone in alumina, usually, and is highly refractory in character.

The 'Hard Bone' occurs directly under the Soft Bone, the two often merging imperceptibly. This variety is dense and hard, and shows small spherules or 'eyes' of dark colored material scattered throughout the ground mass of the clay. It was at first supposed that these consisted of highly aluminous material in the nature of gibbsite or diaspore, but later investigation seems to indicate that the alumina is carried by the ground-mass of the clay substance, and that the dark spots are merely in the nature of segregations of ferruginous matter.

A dry lump of Hard Bone, when placed in water, will rapidly crack down into a loose mass of small, sharp-edged fragments, which show no further softening even on prolonged soaking. The resulting mass of fragments is sandy and noncoherent, with no appreciable plasticity. If, however, the grains are strongly worked, or crushed to fine mesh, a surprising degree of plasticity is developed, and particularly an extremely 'sticky' quality, the clay adhering so strongly to a knife blade or mortar pestle that it is washed or scraped off with difficulty.

The Bone clays, as mined, burn to a grayish-white body, considerably check-cracked, and having a dull ring. They are exceptionally well suited for the manufacture of high-alumina refractories, and are already extensively used for such purposes, and for the special electrically fused refractories previously mentioned. Experimentation along the line of refining these clays by washing, etc., has shown that a fine plastic white-burning material can be obtained, and it is probable that this will ultimately be produced for use in porcelains and china. The accompanying analysis indicates the general composition of the Bone clays. The alumina content varies somewhat according to the locality in which the clay is developed.

**Analysis of Bone Clay.*

	Per cent
Silica -----	44.22
Alumina -----	39.52
Iron oxide -----	2.08
Titanium oxide -----	1.50
Lime -----	.39
Magnesia -----	Trace
Sodium and potassium oxides -----	Trace
Chlorine -----	.02
Sulphuric anhydride -----	None
Carbon dioxide -----	Trace
Moisture, 105 degrees C. -----	.30
Combined H ₂ O and volatiles -----	12.10
	<hr/> 100.13

*Analysis by Smith Emery Company, Los Angeles, Cal.

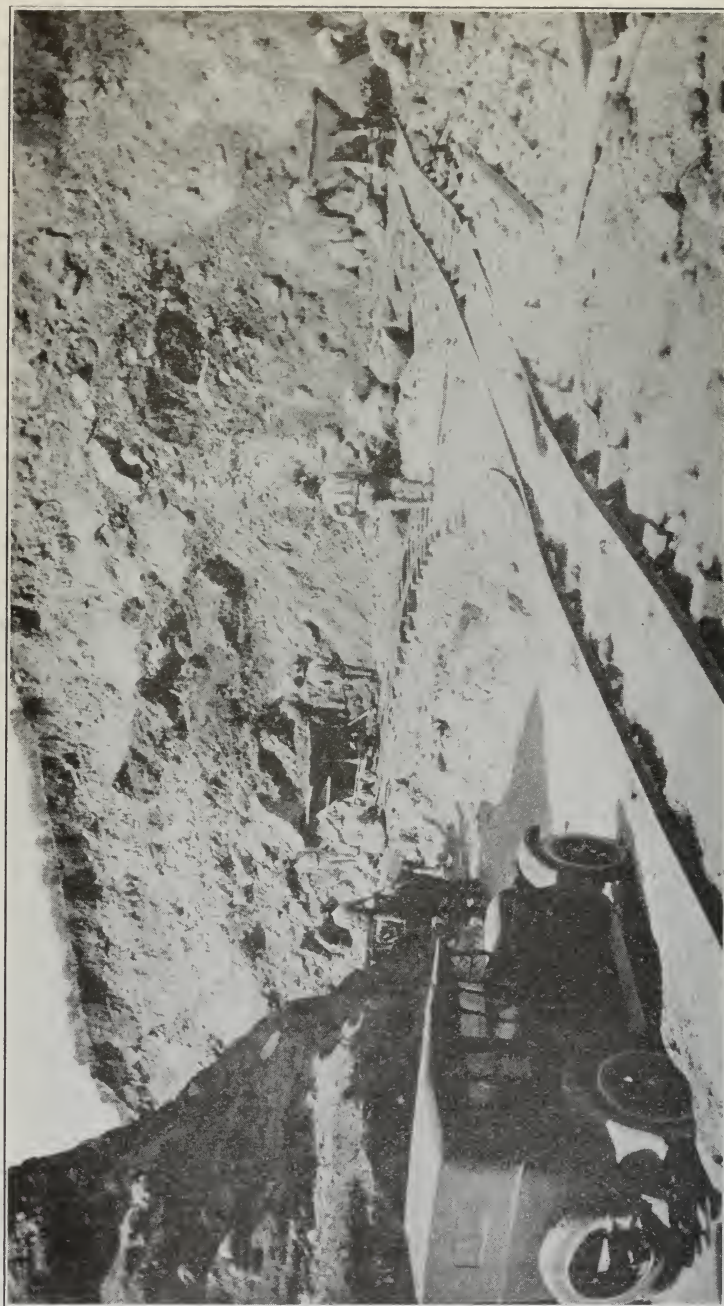


Photo No. 14. A portion of the Hill Blue Pit of the Alberhill Coal and Clay Company. In addition to Hill Blue Clay, another variety, known as Hill Blue-Green, is mined in this pit from the stratum overlying the Hill Blue.

HILL BLUE CLAY.

This clay is one of the most widely used clays mined at Alberhill, by reason of its clean character, high plasticity, and safe drying and burning character. It has many of the qualities of a good ball clay, with much safer burning and drying qualities than usual in a clay of such high plasticity, and less shrinkage. It is extensively employed as a bond clay, and for helping the plastic working qualities of mixes in a wide variety of products.

Hill Blue is an excellent sagger clay, and will carry with ease 50 per cent of grog, or large proportions of less plastic clays. Among the important uses for which it is suited, in correct combination with other Alberhill clays, are faience tile bodies, terra cotta, face brick, enameled brick, yellow bowls, garden terra cotta, pottery, stone ware, and similar products. In fact, Hill Blue is a useful clay in almost any mix where extreme whiteness is not a requisite. Very large single pieces of garden terra cotta, such as vases up to seven feet in height and of large diameter, are made from mixes of Alberhill clays in which Hill Blue is a main constituent, and these habitually come from the kilns without a single crack or check.

Hill Blue burns to a creamy color, the color darkening somewhat at high temperatures. It breaks down without difficulty, though a little more slowly, in water, than the majority of the Alberhill clays, owing to its very plastic character. Like the other Alberhill clays, it has a long heat range, and produces very strong bodies from Cone 1 or less to well above Cone 10. At Cone 9 the body is very hard and dense, but not quite vitreous, and the shrinkage only one in nine or one in ten. The accompanying analyses indicate its general composition.

<i>*Analyses of Hill Blue Clay.</i>		Per cent	Per cent
Silica -----		57.48	53.92
Alumina -----		23.39	25.57
Iron oxide -----		2.55	3.83
Lime -----		.89	1.29
Magnesia -----		.48	.59
Sodium oxide -----		.54	.55
Potassium oxide -----		.51	.40
Sulphur trioxide -----		.08	.28
Moisture, 105 degrees C. -----		5.23	3.00
Loss on ignition -----		8.61	

*Analyses by Raymond G. Osborne, Los Angeles, Cal.

WEST BLUE CLAY.

SELECT WEST BLUE CLAY.

These two clays are commercial varieties derived from the same bed, the 'Select' grade being a somewhat cleaner variety. Both are somewhat less plastic and carry more sandy matter than Hill Blue, but this does not seem to interfere with their usefulness to any appreciable degree, and these clays rival Hill Blue in their extensive application and general usefulness. The stratum in which they occur is one of the thickest and most massive found at Alberhill.

Either of these clays, when slipped, screened, and treated with electrolyte in the usual way, makes a perfect natural casting mix without addition of any other constituent. Pottery made in this way burns to

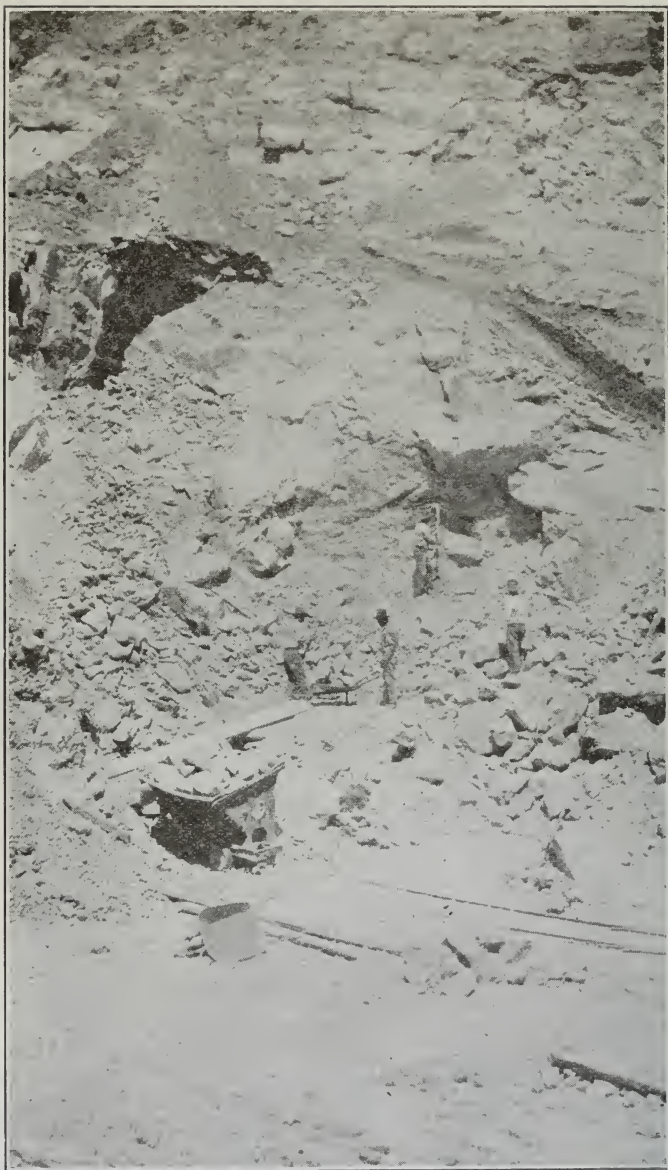


Photo No. 15. Mining Select West Blue Clay, Lower West Pit of the Alberhill Coal and Clay Company. The massive character of the bed is evident. Everything shown here is marketable clay. Hard Bone Clay overlies the Select West Blue at this point.

a strong porous body at ordinary heats, the color being creamy or buff depending on the character of the fire, degree of heat, etc. The great field for the use of these clays, however, at present lies in such products as face brick, terra cotta, electrical conduit, ladle brick, roof tile, hollow tile, etc. The raw clays, up to Cone 9 or beyond, burn to a tight body of creamy color, with appearance of a black speckle at the higher temperatures.

D.C. CLAY.

This material is that previously mentioned as yielding a china clay on washing in the usual way. The crude clay consists of a fairly plastic clay substance carrying a large proportion of sandy and shaly detritus. In washing, a separation of about 50 per cent of fine smooth clay substance is obtained, depending somewhat on the extent to which the refining process is carried. The crude D.C. Clay, burned at Cone 9 or above, produces a white body with an intense black speckle, closely resembling the manganese speckle gray brick so widely marketed. These black specks are due to the shaly or granitic material of the crude clay, and it seems probable that the residue obtained from washing will make an excellent substitute for the manganese commonly employed to produce the black speckle in gray brick.

Following the usual washing process and separation of this sandy material, a china clay equal in plasticity to most grades of English china clay is obtained. The burned color at Cone 9 or above is not so good as that of the English clays, but further experimentation in refining seems to indicate that the burned color may be considerably improved by better methods of washing, and it is believed that a china clay applicable to the customary uses of the English clays will be obtained eventually. The washed D.C. Clay so far produced shows much promise, as it has valuable qualities in the way of promoting quick draining, safety, and readiness in freeing from the mold to casting slips, and its plasticity allows of easy jiggering and general working in the plastic state. It is a very safe material, and its shrinkage is less than that of the usual English china clay. The following analysis indicates the composition of the washed material.

<i>*Analysis of Washed D.C. Clay.</i>		Per cent
Silica -----		48.18
Alumina -----		35.99
Iron oxide -----		1.74
Lime -----		.48
Magnesia -----		.55
Alkalies (sodium and potassium oxide) -----		2.03
Loss on ignition -----		11.22
		<hr/> 99.99

*Analysis by The Western Precipitation Company, Los Angeles, Cal.

RED-BURNING CLAYS.

A number of red-burning clays of good quality are produced at Alberhill, among which only the more important will be mentioned here. The Alberhill red clays, as a class, are unusually refractory, many of them enduring Cone 9 without destructive over-burning. They have in consequence a long heat range conducive to safety in the kiln.

RED MOTTLE CLAY.

This is a plastic clay of blood-red color or salmon-red color in the raw state, more or less mottled with white. It burns to a fine red color, and is suited for quarry tile, roof tile, red and flashed brick, sewer pipe, and red wares generally. Red Mottle clay breaks down at once in water, and works medium plastic. In quality it is fine-grained, clean, and smooth. At Cone 3 the body is dense and hard, with practically no adherence to the tongue, shrinkage plastic to Cone 3, 1 in $6\frac{1}{2}$, color a fine red.

PINK MOTTLE CLAY.

This clay is uniquely beautiful in its natural state, as it consists of a fine wavy mottling of red, blue, white, lavender, and purple sediments, resembling a fine variegated marble. It breaks down at once in water, and works up to a state of medium plasticity, but its burned color is not so good as that of the Red Mottle. Pink Mottle, unlike most of the Alberhill red clays, is overburned to a destructive degree at Cone 9. At Cone 3 the body is dense and hard, with little adherence to the tongue, shrinkage plastic to Cone 3, 1 in 10, color a fair red, but would be improved by addition of barium carbonate in the usual way. Owing to its low shrinkage, Pink Mottle is a useful clay in combination with red-burning clays of high shrinkage but otherwise desirable quality. It is a very useful clay for such products as sewer pipe, hollow tile, paving brick, and red wares generally, where the finest color is not required, and may be added in considerable quantity to mixes for fine red wares also, where a clay-like red mottle is used to give the desired color to the product. The following analysis indicates the general composition of Pink Mottle.

<i>*Analysis of Pink Mottle Clay.</i>		Per cent
Silica		68.00
Alumina		15.07
Iron oxide		7.69
Titanium oxide96
Lime		None
Magnesia		Trace
Alkalies (sodium and potassium oxide)		2.68
Moisture, 105 degrees C.60
Combined water and volatiles		4.65
Chlorine13
Sulphuric anhydride		None
Phosphoric anhydride		Trace
Manganese oxide		Trace
		99.78

*Analysis by Smith Emery Company, Los Angeles, Cal.

RED BONE CLAY.

As the name indicates, this clay is a reddish variety of the bone clays previously mentioned, and it exhibits many of their peculiarities, particularly in its behavior when wetted. It breaks down, like the white bone, into an aggregation of angular fragments which do not soften appreciably unless strongly worked or crushed. Red Bone is a refractory clay, enduring Cone 9 without difficulty, and has proved a useful 'back-bone' clay in sewer-pipe mixes. It can be used to advantage in mixes for the production of fine red and flashed brick and gun-metal

brick, but its most important use so far has been for saggars. Combined with certain other Alberhill clays, it gives an exceptionally durable sagger, and it is utilized for that purpose to an extensive degree.

WEST YELLOW CLAY.

This clay is of a rather low-heat character, compared with most of the Alberhill red clays, being nearly vitreous at Cone 3. The burned color is a bright red, not quite so good as that of Red Mottle. At Cone 9 the body shows attractive flashings of purple and gun-metal shades. While West Yellow has only moderate plasticity, it acts like a ball clay in drying, being slow to dry and tending to warp. It is unsafe in burning, and requires to be mixed with other safe clays, but it is a useful clay in a variety of products, especially fine red and flashed brick, quarry tile, sewer pipe, roof tile, and sagger mixes where it is desired to tighten the burned sagger somewhat. This clay breaks down somewhat slowly in water.

HILL BLUE GREEN.

Hill Blue Green is chiefly valuable for its plasticity, vitrifying qualities, and attractive flashed color at higher temperatures. It is very unsafe alone and must be used sparingly with safer clays. It is adaptable to mixes for the production of roof tile, sewer pipe, quarry tile, red and flashed brick, and paving or sewer brick. It breaks down somewhat slowly, but without difficulty, in water.

WEST TUNNEL BLUE.

This clay is not so attractive as Red Mottle or West Yellow in burned color, but possesses a valuable quality in that it dries to an exceptionally strong body in the 'green' state. It is therefore a useful clay in sagger mixtures where it is desired to add to the strength of the dry sagger before burning, so that it may be handled safely, and also to tighten the burned body somewhat. It is a clay of only moderate plasticity, and carries a considerable amount of shaly and sandy material. The shrinkage is low—1 in 10, plastic to Cone 3—and it is a safe clay advantageous to mix with the fatter clays. West Tunnel Blue is useful in sewer pipe, red and flashed brick, roof tile, and hollow tile mixes. The following analysis indicates its general composition.

*Analysis of West Tunnel Blue.

	Per cent
Silica -----	55.08
Alumina -----	15.50
Iron oxide -----	9.80
Titanium oxide -----	1.04
Lime -----	1.40
Magnesia -----	2.40
Alkalies (sodium and potassium oxide) -----	1.04
Moisture, 105 degrees C. -----	5.62
Combined water and volatiles -----	8.08
Chlorine -----	.07
Sulphuric anhydride -----	None
Phosphoric anhydride -----	.20
Manganese oxide -----	Trace

 100.23

*Analysis by Smith Emery Company, Los Angeles, Cal.

RED SHALE.

A large bed of this material is available at Alberhill, but has so far undergone no commercial development. It does not break down in water, and requires to be ground previous to use. Bricks made of this ground shale show a very fine red color, superior even to that of the Red Mottle Clay.

LIGNITE COAL.

A large tonnage of this material occurs at Alberhill in a bed ranging from 2 to 11 feet in thickness. The degree of consolidation varies considerably, some of the material approximating coal in character, while in other localities soft and loosely compacted varieties occur. At present the coal is not marketed in any considerable quantity, but it is probable that it will be a factor of importance in the future of Alberhill, since it comprises a large supply of cheap fuel exactly on the spot where fuel is necessary. Investigations into the possibility of distilling or bricketting this coal are now in progress, and its use as a powdered fuel does not appear to offer any great difficulties. A trial made along these lines showed that high temperatures were readily obtainable with the Alberhill coal as fuel. The accompanying analyses indicate the average values:

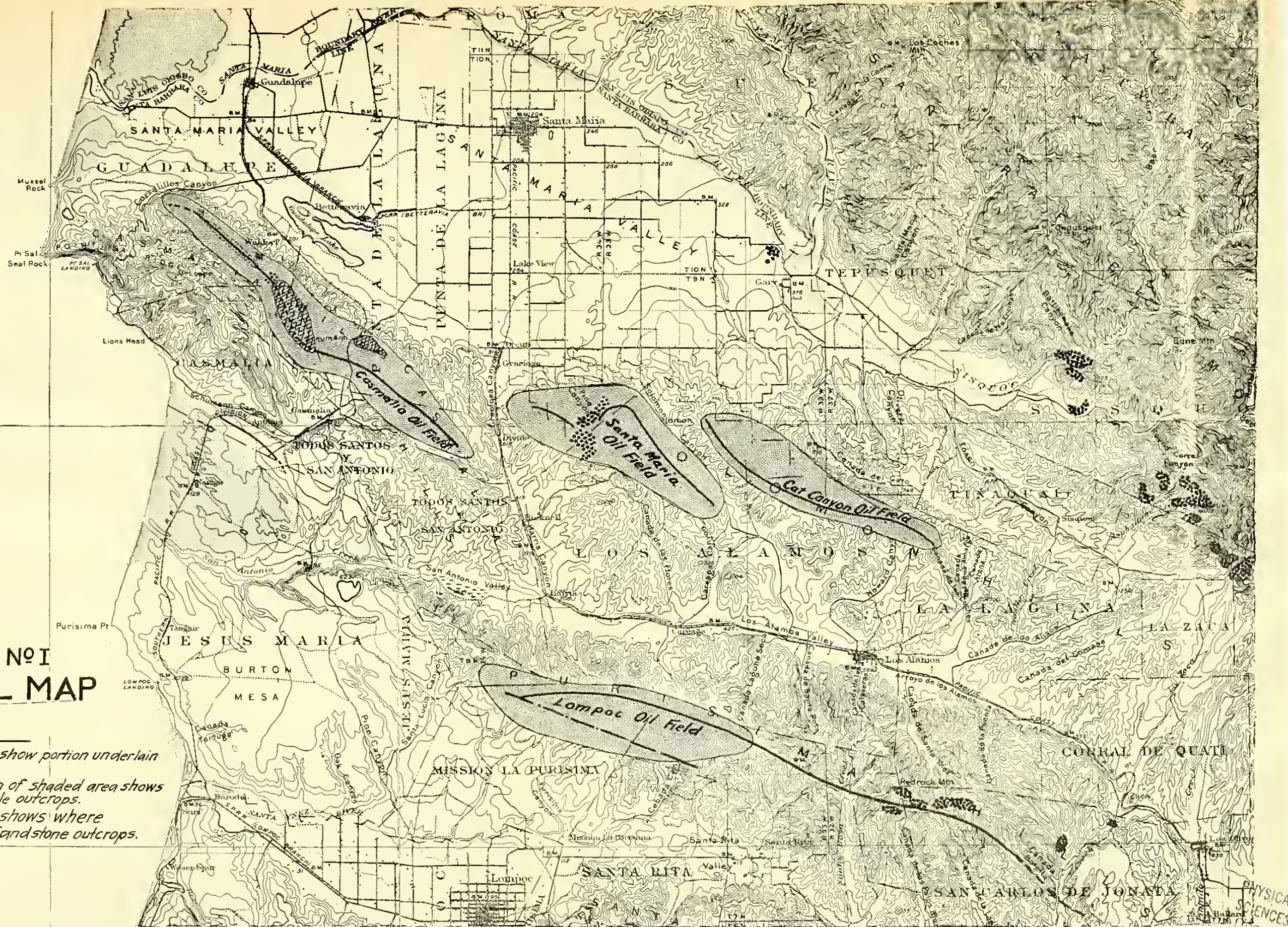
<i>*Alberhill Coal.</i>		Per cent
Moisture -----		24.20
Volatile matter -----		47.67
Carbon -----		12.77
Ash -----		14.70
Sulphur -----		.66
<i>*Alberhill Lignite.</i>		Per cent
Moisture -----		24.46
British thermal units, as received -----	7,870	
British thermal units, dry basis -----	10,410	

*Analysis by Smith Emery Company, Los Angeles, Cal.

[NOTE.—A comprehensive exhibit of the principal varieties of the above-described clays is on display in the Mineral Museum of the State Mining Bureau, San Francisco.—EDITOR.]

Plate No I AREAL MAP

Shaded areas show portion underlain
by Oil Shale.
Hatched portion of shaded area shows
where Oil shale outcrops.
Dotted area shows where
Bituminous Sandstone outcrops.



OIL SHALE IN SANTA BARBARA COUNTY, CALIFORNIA.

By F. D. GORE.^a

Introduction.

California produces oil at the present time from natural resources in three different ways, namely:

1. Drilling and tapping underground reservoirs from which oil flows or is pumped.

2. Extraction, by means of solvents from bituminous rock.

3. Destructive distillation of oil shale.

The first method is, of course, the most important and California production of oil today equals about one-third that of the United States.

The second method is practically of no interest at the present time. While there are numerous deposits of bituminous rock easily accessible in California, the future of the industry depends entirely upon the market price of oil, as this process of extraction is comparatively costly.

The largest deposit of bituminous rock in the coast region of California is located about five miles south of San Luis Obispo. Wells in the Arroyo Grande Oil Field are producing a low gravity oil from this sandstone, commonly known as Pismo Formation.

There are other deposits of less importance distributed over a large area in Santa Barbara County, the locations of which are shown on Plate No. 1.^b Some of these deposits have been mined years ago for the high grade of asphalt obtained.

There are at the present time two plants under construction for the recovery of oil from bituminous rock in San Luis Obispo County. A description of one of these plants is given in the California State Mining Bureau publication 'Mining in California' under date of June, 1922. The process is briefly as follows: The oil saturated sandstone is conveyed from the mine to the plant by a ground sluice which empties into a double screw log washer. From the log washer it passes through a Cottrell vibrating screen, which removes the gravel. From the vibrating screen the sand passes through three K and K mixers in parallel and from here the material flows to eight K and K flotation machines used as roughers. From the roughers the flotation oil concentrate is sent to four K and K flotation cleaning machines. From the cleaners the oil concentrate goes to two additional K and K cleaners and then to a Dorr thickener. From the thickener the concentrate is sent to a storage and settling tank. It is then ready to be refined.

There has not been sufficient progress made on the other plant to warrant a report at this time.

The third process is becoming more important as the oil obtained from the bituminous shale is peculiarly adapted to use as flotation oil, an oil used in the recovery of sulphide minerals in ores.

This paper deals primarily with the oil shale industry of Santa Barbara County, California, and sets forth the location of the deposits, geological conditions governing the occurrence of same and the description of the different processes now in operation.

^aF. D. Gore, Deputy Supervisor, District No. 3, Santa Maria, California.

^bPlate No. 1—Areal map of oil shale deposits in Santa Barbara County.

Acknowledgements.

To Mr. G. W. Wallace, Consulting Engineer, and Mr. F. G. Green, Chemist, for the N. T. U. Company, the writer wishes to acknowledge his thanks for information concerning the different chemical analyses of shale oil.

To Dr. David T. Day, the writer is indebted for information concerning the Day Process of oil extraction.

A COMPARISON OF CALIFORNIA OIL SHALE TO OTHER SHALES.

The principal deposits of oil shale occur in Santa Barbara and Ventura counties, in and near the present producing oil fields. The production of oil in the Santa Maria, Casmalia and Lompoc oil fields is obtained from this oil shale, commonly termed 'brown shale.'

The oil shale of California should not be confused with the shales of other parts of the United States and foreign countries, as it is different both physically and chemically. It is in a truer sense an oil-saturated diatomaceous shale from which oil may be extracted by the use of any of the well known solvents, such as benzol, chloroform, pyridine, et cetera.

Utah and Colorado shales are similar to the Scotch shales in the character of their Kerogen Content. New Brunswick shale, on the other hand, differs slightly in that it resembles a Torbanite. The shales of Indiana, Illinois and Kentucky vary considerably, some of the deposits resembling the Utah and Colorado deposit, with this exception: The oils produced as a result of destructive distillation contain a higher percentage of so-called tar acids (phenols and creosotes); in fact, shales are known in Illinois which yield oil similar in every respect to the low temperature distillation products from coal, containing, in some instances, as high as 30% tar acids. This indicates that some of these so-called shales are in reality a low grade Cannel coal.

The shales of Utah, Colorado and New Brunswick contain a solid bitumin which, when destructively distilled, yield an oil. This bituminous matter is insoluble in any of the well known solvents, and the oil is only obtained as a result of destructive distillation reactions.

The spent shale or residue from both the Colorado and Utah shales are largely silicates of one form or another, having a high aluminum content, whereas the California shale residue is high in silica.

PHYSICAL PROPERTIES OF DIFFERENT OIL SHALES.

Source	Moisture	Volatile material	Fixed carbon	Ash	Sulphur	Approximate percentage of extraction by solvents	Nitrogen
Nevada.....	2.4	29.3	4.2	64.4	4.	-----	.43
California.....	6.67	25.41	5.37	62.55	1.8	9-22	-----
Utah.....	.75	41.95	2.80	54.50	2.1	1.0	.60
Colorado.....	1.3	21.7	16.3	60.7	1.1	2.4	.70
Wyoming.....	.2	35.3		64.5	-----	1.75	.40
Kentucky.....	.7	28.6	0.7	70.0	3.8	.14	.60
New Brunswick.....	1.5	16.0	4.5	78.0	1.2	0.8-2.5	-----
Scotland.....	1.0	22.0	4.0	73.0	1.4	1.9-2.4	.5-.9
New South Wales Capertee.....	1.05	46.52	32.13	20.2	.35	.3	.3

Distillation Test on Sample of California Oil Shale near Casmalia.

By Smith, Emery and Company, Chemists and Chemical Engineers.

Initial boiling point.....	212° F.
Water.....	0.5%
Oil distilled at 425° F. 0.8%—Spec. gr.....	.8396—36.7° Baume

Distillation continued with steam, collecting the distillate in 10% fractions as follows:

	Fractions	Temperature	Specific gravity at 60° F.	Baume
1.....	(10%)	535° F.	.882	28.7°
2.....	(10%)	600° F.	.917	22.7°
3.....	(10%)	655° F.	.941	18.8°
4.....	(10%)	676° F.	.965	15.1°
5.....	(10%)	738° F.	.983	12.4°
6.....	(10%)	760° F.	.995	10.7°
7.....	(5%)	765° F.	1.003	(heavier than water)

The residue in the still-bottom consisted of a soft, asphaltic material, composing about 34 per cent of the original oil.

As the first two fractions of the steam distillate were very low in viscosity at ordinary temperatures, while the fractions 3 to 7 were somewhat viscous, the distillate was divided into these two portions and tested as follows:

	Fractions 1 and 2 inclusive	Fractions 3 to 7 inclusive
Specific gravity at 60° F.....	.906	.979
Baume.....	25.0°	13.0°
Flash.....	180° F.	285° F.
Cold test.....	Below -40° F.	+25° F.
Sulphur (S).....	3.69%	4.47%
Nitrogen (N).....	0.18%	0.31%
Unsaturated compounds.....	34.71%	50.39%
Viscosity, Saybolt at 100° F.....		124 seconds

REPORT OF ANALYSIS OF NEW BRUNSWICK SHALE AND BY-PRODUCTS—SEPTEMBER 24, 1921, BY F. G. GREEN, CHEMIST.

Initial B. P. 216° F. Distillation Test of Oil Recovered (10% Fractions) Sp. gr. Crude Shale Oil. 908

Acid loss	Fractions	Temperature	Sp. gr.	Flash p.	Burn	Cold test	Paraffin	Aromatics	Unsaturated hydro carb.	Nitrogenous oils	Phenols	Saturates
28.4	10%	401	.787	32	46	---	49.9	21.7	26.1	2.1	.2	71.6
28.2	20%	484	.826	108	117	---	53.9	17.9	24.4	3.8	.6	71.8
35.8	30%	540	.854	160	176	---	43.0	21.2	30.9	3.8	1.1	64.2
35.4	40%	604	.875	210	234	---	37.5	27.1	29.9	4.3	1.2	64.6
40.0	50%	609	.884	148	218	---	29.7	30.3	34.0	4.9	1.1	60.0
46.0	60%	625	.880	72	120	---	29.9	24.1	40.9	4.9	.8	54.0
50.6	70%	620	.888	60	116	58	32.8	17.6	46.6	3.8	.3	50.4
49.4	80%	634	.900	56	88	44	37.9	12.7	46.0	3.2	.2	50.8
49.7	90%	590	.926	62	114	50	42.0	8.3	46.7	2.7	.3	50.3

Analysis of
Shale

Analysis of
Residue

Moisture.....
Volatile matter.....
Fixed carbon.....
Ash.....
Sulphur.....
Nitrogen.....

CO₂.....
*H₂.....
O₂.....
CO.....
CH₄.....
H₂.....
N₂.....
B.t.u., 593.5 per cu. ft.

1.55
15.21
4.06
79.08
1.36

2.85
7.88
89.97
1.18

Gas Analysis 24.6
24.3
12.1
21.8
16.8
10.4

Ammonium sulphate recovery—30 pounds per ton.
Sulphur in the oil—1.2%.

*Illuminants or such hydrocarbons as are heavier than methane.

REPORT OF ANALYSIS OF COLORADO SHALE AND BY-PRODUCTS, AUGUST, 1921.

Distillation Test of Oil Recovered.
(10% Fractions)

Initial B. P. 185° F.

Sp. gr. Crude Shale Oil .912

Fractions	Temperature	Sp. gr.	Flash p.	Burn	Cold test	Acid loss
10%-----	388	782	-----	-----	-----	9.4
20%-----	459	829	99	120	-----	10.8
30%-----	523	864	159	170	-----	16.0
40%-----	590	892	208	237	-----	30.0
50%-----	629	906	232	264	44	28.0
60%-----	640	911	96	212	53	34.0
70%-----	590	875	58	98	52	22.0
80%-----	617	886	64	80	53	22.8
90%-----	685	903	63	86	55	36.2
92.2%-----	-----	950	52	64	87	13.5
End point-----	716	Loss, by volume 7.8%; by weight 1.32%.				

Ammonium sulphate recovery, 19.8 pounds per ton.

	Analysis of shale	Analysis of residue
Moisture-----	1.29	0.79
Volatile matter-----	21.72	0.95
Fixed carbon-----	16.31	7.10
Ash-----	60.68	91.16

Gas Analysis

CO ₂ -----	7.5
*Ill-----	3.1
O ₂ -----	.0
CO-----	5.0
CH ₄ -----	32.0
H ₂ -----	41.9
N ₂ -----	10.5
B.t.u. per cu. ft., 561.	

*Illuminants or such hydrocarbons as are heavier than methane.

Location of Deposits.

The areal map shows the location of the principal deposits. The data necessary for platting the different deposits was obtained by a careful survey of the different structures in and near the oil fields of Santa Barbara County, and by a study of the logs of wells drilled in this area.

Geological Conditions Governing the Deposits of Oil Shale.

The larger beds of bituminous shale appear in the lower series of the Monterey shales of the middle Miocene period and are calcareous and flinty. Due to the highly fractured state of the beds caused by folding, a reservoir for the accumulation of oil is formed. These bodies of bituminous shale are overlain with the upper series of the Monterey shales and in places the Fernando and Terrace formations.

Wells in the Santa Maria field have penetrated these beds at an average depth of 2000 feet and in the Casmalia field at a depth of approximately 700 feet, gradually becoming shallower in a northwesterly direction along the Schuman Anticline until the base of the Monterey shale is exposed and the underlying Vaqueros formation outcrops.

The relation of the bituminous shale to the overlying formations depends entirely upon the porosity of the upper shale beds due to fracturing. There are portions of the anticline where sharp folding has caused fractured zones to extend from the main body of bituminous shale to the surface and it is here that the oil from below has migrated upward, impregnating the upper bodies of shales. At these locations not only are the shales saturated with oil, but all the seams and fissures

are filled with asphalt, due to the evaporation of the higher volatile substances in the crude oil. Such conditions exist at different points on the Schuman anticline, starting at the railroad cut at Schuman Station and following the anticline in a northwesterly direction to Corralitos Canyon.

Accessibility of Deposits.

The major portion of deposits which would justify exploitation are easily accessible by wagon roads and are an average distance of two miles air line from the railroad station of Schuman.

Overburden.

The amount of overburden varies considerably on all of the deposits. A general idea of the amount of overburden on one of the largest deposits may be obtained from a study of the contour map, Plate No. 2.^c The data on overburden were obtained by digging pits until the brown shale was encountered. The overburden will offer no serious handicap during the mining of the shale, as all of the work may be open cut and can easily be stripped by steam shovels. The overburden consists of unproductive Monterey shale, overlain by a small deposit of silt and decomposed vegetable matter. This area is sparsely covered with scrub oak bushes and brush.

History of Early Operations.

Since 1900 several attempts have been made to mine the asphalt deposits of this area and it is reported that the operations were profitable, as a high grade asphalt was obtained, but in later years the oil industry and the manufacture of asphalt brought the price so low that the asphalt mines mentioned herein had to be abandoned.

One company, operating what is known as the Waldorf Mine, drove a tunnel into the hill to a distance of 1500 feet, following a fissure, which was filled with asphaltum. This mine has long since been abandoned and is now unsafe for entrance.

Companies Now Operating for Oil.

THE DAY COMPANY.

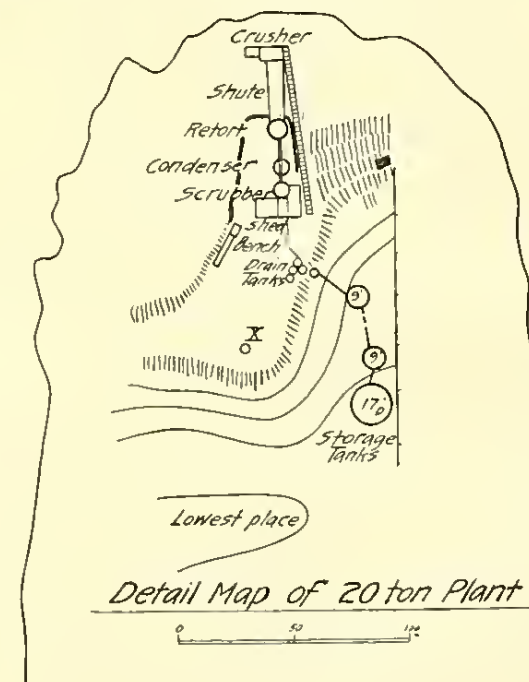
Dr. David T. Day is operating an experimental plant at the railroad cut near the station of Schuman. The Day Process is that of destructive distillation and cracking to obtain lighter oil for the purpose of making gasoline and lubricating oils. The method of mining is by open cut. Small dump cars are filled with shale and conveyed to the crusher on a small track. The shale is dumped into crusher bins and from there into crushers where it is reduced to the size of about one and one-half inches in diameter. From here it is conveyed to another bin which has an adjustable outlet determining the rate of feed to the tubular screw conveyors, as shown on the flow sheet, Plate No. 3.^d The shale travels through the three tubular screw conveyors to the retort at a predetermined rate of speed for maximum extraction of oil. As the shale enters

^cPlate No. 2—Contour map of oil shale deposits.

^dPlate No. 3—Flow sheet of Dr. Day's process.



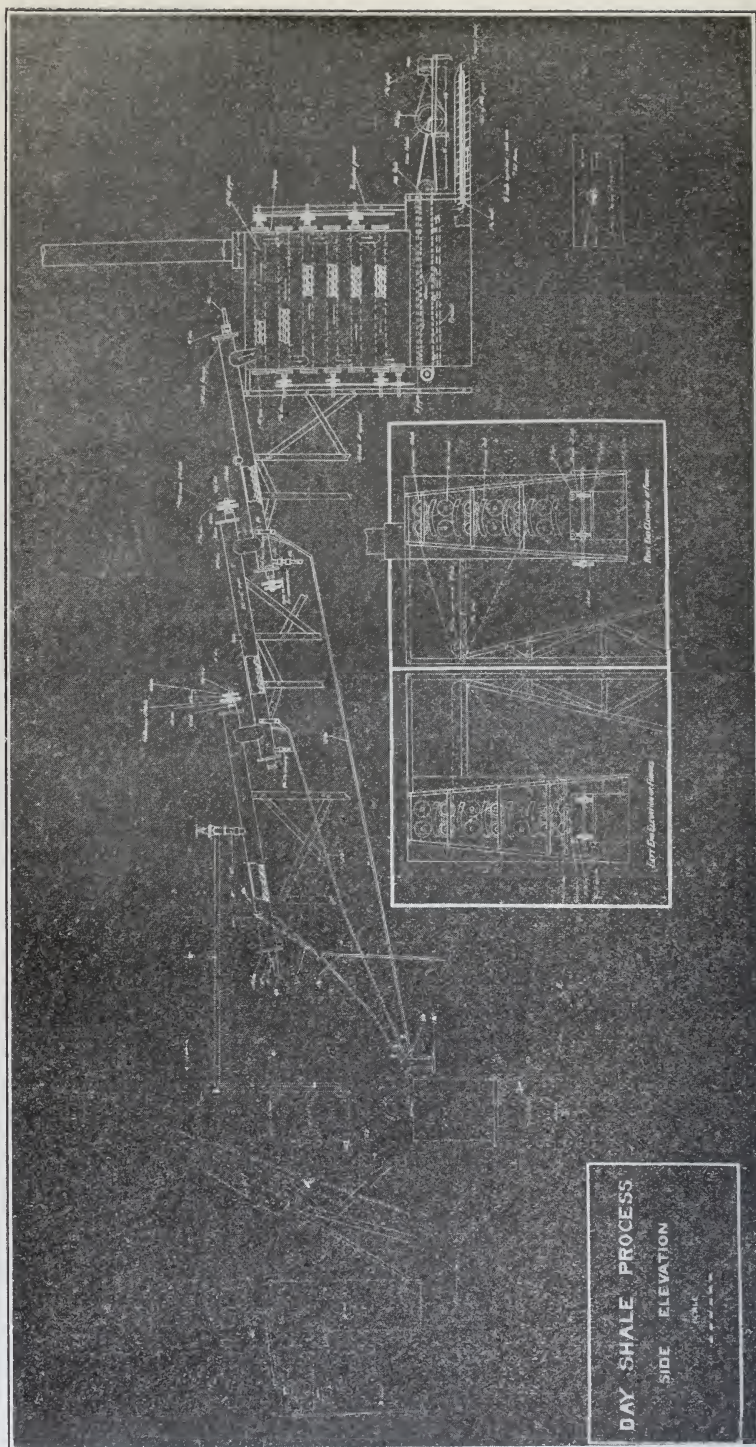
A number line is shown with major tick marks at -200, 0, 200, 400, and 600. A bracket above the line indicates a distance of 200 units from 0 to 200.



PHYSICAL
SCIENCES
LIBRARY



Day shale oil plant near Schuman Station, Santa Barbara County, Cal.



the retort, where an average temperature of about 800 degrees Fahrenheit is constantly maintained, destructive distillation is begun. The higher volatiles are driven off first and continuing on down to the residium as the shale approaches the fire box. Enough carbon remains in the shale to maintain a constant heat in the fire box or combustion chamber, which slowly deposits the spent shale by means of a LaCledé-Christy chain stoker to an endless-chain drag which deposits the spent shale at the dump.

As the gasses are driven off the shale upon entering the retort they follow back through the tubular screw conveyors and are partially condensed upon encountering the cold shale. As condensation takes place the incoming shale is preheated to a certain extent and given a bath of oil and as the oil is fed back towards the retort, cracking takes place, which results in a high gravity product. The average amount of oil obtained is about 30 gallons per ton of shale. According to data furnished by Dr. Day, the resultant product contains as follows:

Gasoline -----	30%
Kerosene -----	15%
Gas-oil -----	15%
Lubricants -----	30%
Residium and Loss-----	10%

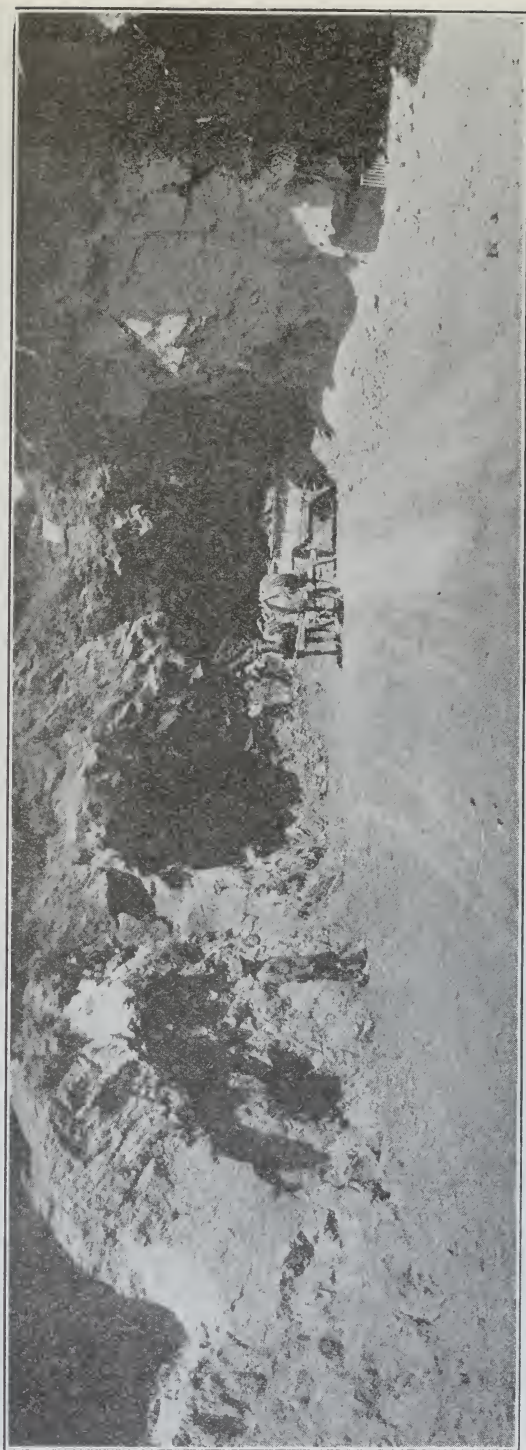
The crude oil contains from 1% to 3% pyridine bases.

THE N. T. U. COMPANY.

The N. T. U. Company, with offices in the Monadnock Building, San Francisco, California, has been operating for the past year on what is known as the Stokes property near Casmalia. On this property are located some of the largest deposits of oil shale in the area under consideration.

A 20-ton plant was erected for experimental purposes and the results obtained were so satisfactory that the company is now erecting a large commercial plant comprising 25 units of 40-ton capacity each, which will handle 1000 tons of shale per day. The open cut method of mining will be followed and the shale delivered to the battery of generators by means of a standard guage railway dump car of 40-tons capacity. In this process it is necessary to crush the shale to pieces of two-inch diameter. The car containing the shale from the quarry, which has been crushed to the desired size, is dumped directly into the generator.

Process Used: The principles involved in the practice of this process differ from retorting methods in that direct internal combustion on the non-oil forming combustible matter contained in the shale is utilized. The combustion is caused to travel progressively downward through a mass of shale contained in a closed chamber, thereby furnishing heat which, travelling downward in advance of combustion, creates a working zone in which the oil is distilled from the shale, either by destructive or simple distillation. None of the oil comes in contact with the hot zone of combustion, as all of it travels progressively downward in advance of the combustion to the bottom of chamber where it is recovered; whereas, in the recovery of oil from shale in all retorting



Main quarry of N. T. U. Company, near Casmalia, Santa Barbara County, Cal.



General view of plant of N. T. U. Company, near Casmalia, Santa Barbara County, Cal.

plants, the method used involves the external heating of a retort or chamber containing the charge of shale.

The process used by this company is fully patented and the patents are owned by the S. E. Company. The N. T. U. Company holds the United States license.

The process consists of a generator, condenser and scrubber. Referring to the flow sheet, Plate No. 4, the generator is first filled with oil shale and fired at the top. The top is then closed, allowing only sufficient oxygen to enter for the purpose of complete combustion. A vacuum is placed on the outlet pipes by means of an electric fan and the direction of fire brought downward through the cold shale. Sufficient vacuum is applied to regulate the proper burning of the shale for the purpose of obtaining the maximum amount of oil and gas there-

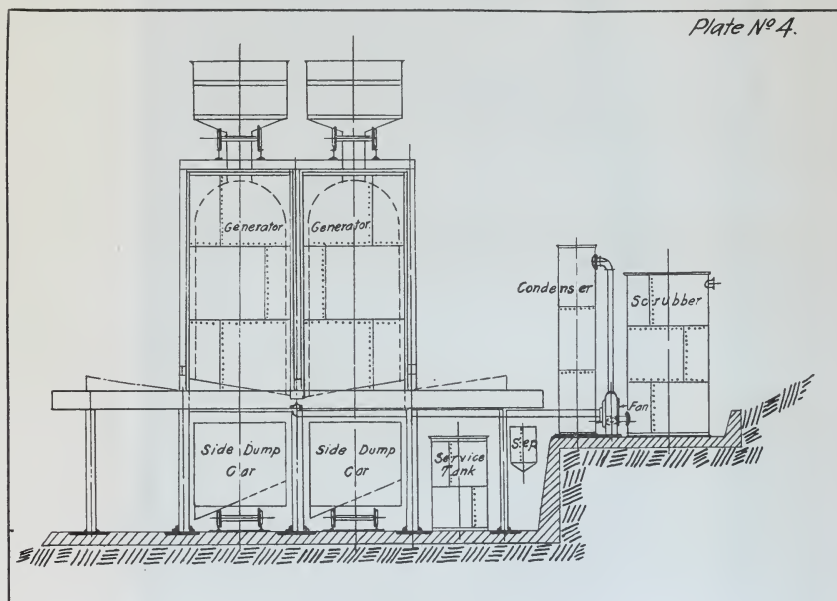


Plate No. 4—Flow sheet of N. T. U. Company's process.

from. As the gasses are driven off by heat they are partially condensed by encountering the cold shale and are further condensed when passing through the condenser and scrubber.

This process of extraction does not crack the oil excessively and as a result the crude oil contains certain properties that make it very desirable for use as flotation oil in the recovery of sulphide minerals in ores.

By this process it is reported that over 90 per cent of the total shale oil can be recovered. The gravity of the oil is about 14 degrees Baumé. As high as 40 gallons to the ton has been obtained. However, the average runs between 30 and 35 gallons to the ton.

Flotation Tests.

Hamilton, Beauchamp & Woodworth, metallurgical engineers of San Francisco, made the following tests for flotation processes:

TEST No. 1.

Flotation Using N. T. U. 'Shale' Oil.

Conditions for Flotation.

Ore:	crushed wet to 80 mesh.
Machine:	mechanical agitation.
Pulp dilution:	4:1.
Temperature:	normal.
Time of agitation:	20 minutes.
Separating reagents:	lbs. per ton of ore.
	1.0 " shale oil.
	.1 " hardwood creosote.
	.1 " pine oil.
	4.0 " crude sodium carbonate.

Results of Test.

	Per cent weight	Assay		Content		Per cent distribution	
		Au \$	Ag ounces	Au \$	Ag ounces	Au	Ag
Head.....	100.0	2.89	24.70	3.038	25.203	100.00	100.00
Conct.....	10.0	24.80	245.28	2.480	24.528	81.63	97.32
Tail.....	90.0	.62	.75	.558	.675	18.37	2.68

TEST No. 2.

Test Made July, 1921.

Conditions for Flotation.

Ore:	80 mesh.
Machine:	mechanical agitation.
Pulp dilution:	4:1.
Temperature:	normal.
Time of agitation:	20 minutes.
Separating reagents:	lbs. per ton of ore.
	1.0 " P. E. collector.
	.3 " hardwood creosote.
	.1 " pine oil.
	4.0 " crude sodium carbonate. (Trona.)

Results of Test.

	Per cent weight	Assay		Content		Per cent distribution	
		Au \$	Ag ounces	Au \$	Ag ounces	Au	Ag
Head.....	100.00	3.10	28.25	3.575	27.24	-----	-----
Conct.....	13.26	23.56	200.16	3.124	26.54	87.38	97.4
Tail.....	86.74	.62	.80	.451	.70	12.62	2.6

Ratio of concentration 7.54:1.

In comparing the results of the two tests, the assays of tailing should be considered rather than the percentage distribution for the reason that the difference shown in percentage extraction is entirely due to a difference in head value between the two samples tested, the tailing assays for gold and silver being almost identical in each case with a slight advantage in favor of Shale oil in the silver extraction."

The following statement as regards the advantages of the Shale oil for flotation purposes was made by Mr. Beauchamp as follows:

"The advantages in favor of 'Shale' oil, as far as the ore under investigation is concerned, seem to be that it tends toward producing a cleaner concentrate and reduces the amount of other frothing oils needed to give the right frothing condition.

Shale oil is easily mixed into the pulp with a minimum of agitation and appears to be an excellent flotation reagent."

Shale Oil vs. Commercial Crude.

It is not likely that shale oil will substitute for our present crude oil as obtained from wells for many years hence. This is due largely to the chemical properties of the shale oil. When first obtained the oil has a gravity of about 14 degrees Baumé and is very low in viscosity. It is bright green in color. When exposed to sunlight the bright green hue is lost and it becomes a dark brown with an increase in viscosity. These changes are apparently due to oxidation hastened by the catalytic effect of the high sulphur content of the oil. The removal of the sulphur compounds is the chief difficulty to be met with in refining. Aromatic hydrocarbons constitute the largest percentage of the oil. Tar acids and nitrogenous oils are present in very small quantities. Shale oil readily emulsifies with the water present in the shale during the process of extraction and is more difficult to dehydrate than the ordinary crude petroleum.

Future Possibilities of the Oil Shale Industry in California.

According to estimates made from available data there is an existing market of approximately 5,000,000 gallons per year of flotation oil. Should shale oil as produced in Santa Barbara county substitute for higher priced collective agents now in use by the mining industry, the extraction of oil from shale will be one of the important industries of this state.

The oil shale industry in its present stage of development is not comparable to the petroleum industry. The methods of obtaining and refining the oil are entirely different and the problems connected with the refining of shale oil are more complex than are those of refining petroleum.

To be successful a company formed for the purpose of producing shale oil must be sound financially and able to procure high technical and business ability. It should also be prepared to carry on exhaustive experiments and be satisfied with a very slow return on the money invested.

AGRICULTURAL MINERALS ACT.

A new state law known as the Agricultural Minerals Act was passed at the last session of the legislature. This law became operative on August 16th, and officials of the Division of Chemistry, State Department of Agriculture, are now enforcing it.

The provisions of this act are of interest to all producers of agriculture limestone, lime, marl, gypsum and other minerals used for soil treatment. The following statement prepared by officials of the Department of Agriculture has been made available through the cooperation of that department with the State Mineralogist:

AGRICULTURAL MINERALS MUST BE REGISTERED AFTER AUGUST 16th.

This law is intended to prevent fraud in the sale of agricultural lime, marl, gypsum, etc., and other minerals sold for soil treatment, and to raise the standard of such substances by requiring the labeling of every lot, giving the percentage of valuable constituents and the name of the registered producer or dealer.

Before any agricultural mineral can be legally offered for sale after August 16th, it must first be registered with the State Department of Agriculture by the producer, manufacturer, importer, agent, or dealer. If it is registered by any one of these parties no other registration is required, provided it is sold in the original, unbroken package of and under the label of the registered party. The registration fee is \$50, regardless of the items registered, and is payable at the time application for registration is made. No provision is made for remitting part of this fee for a part of the year. All registrations expire on the thirtieth day of June, 1924.

If an agricultural mineral is sold under a trade name or brand it is necessary to file with the Director of Agriculture a sworn statement of its composition. All remittances must be made payable to the State Department of Agriculture.

The scope of the law as defined in section 2 reads in part as follows:

The term 'agricultural mineral' as used in this act shall include any mineral substance, or mixture of mineral substances, or mixture of mineral and organic substances intended to be used for promoting or stimulating the growth of plants, increasing the productiveness of plants, or producing any chemical or physical change in the soil * * *.

The law, however, does not apply to minerals or mixtures containing nitrogen, phosphoric acid, or potash in commercial quantities, such as potash salts, superphosphates, nitrate of soda, nitrate of lime, cyanamid, sulphate of ammonia, etc. These must be registered under the California Fertilizer Law of 1903 as before. Raw phosphate rock and mixtures of this with lime or sulphur may be registered under either law.

Each lot of agricultural mineral must be labeled or tagged, stating:

1. Name, brand, or trade mark.
2. Name and address of the registered producer, manufacturer, importer or dealer.
3. Place of manufacture or production.
4. The word 'registered' and the registration number.

5. A chemical analysis stating the percentage of every constituent claimed to be in the product.
6. A statement of the minerals from which all guaranteed constituents are derived.

Inspectors of the department will take up samples of agricultural minerals from time to time at the quarry, at the warehouse, and in the hands of dealers and purchasers as seem necessary to determine compliance with the law.

Samples of agricultural minerals may be submitted to the department by anyone to be tested to determine compliance or not with guarantee. The fees for making these tests are to be determined by the Director of Agriculture.

In addition to license fees, the enforcement of the law is provided for by means of a tax of 10 cents on each ton sold in the state.

Noncompliance with any part of the law constitutes a misdemeanor punishable by a fine of \$50 for the first offense and \$100 for each subsequent offense.

Section 10 reads as follows: "The Director of Agriculture shall have the power, after hearing, to cancel the registration of, or to refuse to register, any agricultural mineral which has been shown to have little or no value for the purpose for which it is intended to be used, or has been shown to be generally detrimental or seriously injurious to the growth or productiveness of plants."

Parties desiring further information should write to the Division of Chemistry, State Department of Agriculture, Sacramento, California.

ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

New District Office.

In line with the efficiency and economy program of the new state administration, the State Mineralogist decided upon the closing of the Redding and Auburn district branch offices of the State Mining Bureau, and their consolidation into a single office located in Sacramento. This was accomplished in June.

The use of office space in the Chamber of Commerce Building, Seventh street, between I and J, was made possible through the cordial cooperation of the Sacramento Chamber of Commerce, which has established a Department of Mines and Mining and is showing every disposition to aid the mining industry of the state by such means as are within its province. For this, the State Mining Bureau and the mining industries are duly appreciative. Historically and geographically, the principal mining districts of central California are and have always been the 'back country' of the capital city, and it is gratifying that the business men of the city have come to realize that the prosperity of the mines at their back door is a matter of business interest to themselves.

The new office of the Bureau at Sacramento will make available for public use in a central location a general information bureau on the mines and the undeveloped mineral resources of the state. There will also be kept at the office, for public reference, practically every geological and mining report issued by the government bureaus dealing with the state's mineral resources, and many maps and reference books of value.

New Publications.

During the period covered by this issue (March 16-September 15) the following Bureau publications have been made available for distribution:

Bulletin No. 91, "Minerals of California"; price \$1.00 post paid.

The first list of California's minerals was published by W. P. Blake in 1866, and it comprised about seventy-five mineral species. California was at that time a new and largely unexplored field, and only a few scattered localities were known for mineral specimens.

The second list appeared in 1884 as a part of the Fourth Annual Report of the State Mineralogist, by Henry G. Hanks; and included double the number of previously known minerals.

A third list was issued in 1914 as Bulletin 67 of the State Mining Bureau, written by Dr. A. S. Eakle, professor of mineralogy at the University of California. In the thirty years which had elapsed since the appearance of the second list our knowledge of geology and mineralogy of the state had vastly increased. The ore deposits of many of the counties, the gem and borate deposits of the southern counties, and the petrography of many districts, had been investigated and described, so that the third list contained more than double the number of definite mineral species given by Hanks, besides many sub-species and varieties.

Publication of a fourth list is now accomplished, being an enlarged and revised edition of the third list and likewise written by Professor Eakle. It has been designated Bulletin 91 of the State Mining Bureau, entitled "Minerals of California." In addition to increases in the number of Californian localities of mineralogic interest, the number of mineral species not hitherto reported in California is considerably increased. One of the new minerals, troilite, has never previously been found on the earth except in meteorites. A new feature of Bulletin 91, not given in previous editions, is the addition of the principal blow-pipe and chemical identification tests for each mineral.

Summary of Operations, California Oil Fields, Vol. 8: December, 1922, No. 6; January, 1923, No. 7; February, 1923, No. 8; March, 1923, No. 9; April, 1923, No. 10; May, 1923, No. 11.

Mining in California, December, 1922, Vol. 18, No. 12.

Mining in California, January, 1923, Vol. 19, No. 1; February, 1923, Vol. 19, No. 2; March, 1923, Vol. 19, No. 3.

Map No. 28, Torrance (Redondo) Oil Field; price 75 cents.

Commercial Mineral Notes: No. 1, April; No. 2, May; No. 3, June; No. 4, July; No. 5, August.

As the timeliness of publication is important in the case of the lists of 'mineral deposits wanted' and 'minerals for sale,' it was decided to issue that information in the form of a mimeograph sheet once a month, since the change to a quarterly status of 'Mining in California' which formerly was the vehicle for disseminating such information. This list is mailed, free of charge, to those on the mailing list for 'Mining in California.'

Mails and Files.

The Bureau maintains, in addition to its correspondence file, a mine report file which includes reports on some 7500 mines and mineral properties in California. Also there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the past three months 3726 letters were received and answered. They are practically all requests for information and the inquiries cover all phases of prospecting, mining and developing mineral deposits, reduction of crude minerals, and marketing of refined products.

Drafting Room.

This is purely a workshop, and is the only branch of the Bureau that is not primarily at the direct service of the public. In the drafting room well logs, maps, sketches, etc., are prepared for the many publications and reports which are under way at all times.

Changes in Personnel.

Since the March issue of 'Mining in California' the following changes in personnel have taken place:

Mr. R. E. Collom, state oil and gas supervisor since January, 1921, has resigned, effective October 1st, to engage in private practice.

Mr. R. D. Bush has been appointed state oil and gas supervisor, vice R. E. Collom resigned. Mr. Bush received his technical training at the University of California, was a deputy and chief deputy oil and gas supervisor of this department 1917-1920, and the past three years has been engaged in technical work with the Empire Gas and Fuel Company in the oil fields of Kansas.

Mr. M. A. Newman, for the past year district mining engineer in charge of the southern district, with offices at Los Angeles, resigned in June, to engage in private practice.

Mr. W. Burling Tucker, district mining engineer in charge of the Redding district, has been transferred to the Los Angeles office of the Bureau.

Mr. C. A. Logan, for the past four years in charge of the Auburn district, has been transferred to Sacramento, in charge of the new district formed by consolidation of the Redding and Auburn districts.

Mr. Forest L. Campbell, a graduate of the University of California in mining engineering, has been appointed librarian of the Bureau, and is in charge of the information desk at the San Francisco office.

Mr. J. J. McDonald, for the past eight years assistant mining statistician, resigned in May, to engage in private business.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

MINERAL PRODUCTION OF CALIFORNIA IN 1922.

Compilation of the direct returns to the State Mining Bureau from the various operators throughout the state show the total aggregate value of the mineral output of California for the year 1922 to have been \$245,183,826, being a decrease of \$22,973,646 from the 1921 total of \$268,157,472. There were fifty-three different mineral substances, exclusive of a segregation of the various stones grouped under gems; and all of the fifty-eight counties of the state contributed to the list.

The salient features of 1922 compared with the preceding year, were: The continued increase in petroleum yield, although of lower prices per barrel; increases in copper, lead, natural gas, brick and tile, and crushed rock; and decreases in gold, silver, cement, and petroleum values. The net result was a decrease in the grand total of all groups of nearly twenty-three million dollars, as stated above. Petroleum accounted for a decrease of \$29,756,960 in total value, although there was an increase in quantity of approximately 26,000,000 barrels.

Of the metals: copper increased from 12,088,053 pounds, worth \$1,559,358, to 22,883,987 pounds, worth \$3,090,582; lead, from 1,149,051 pounds and \$51,707, to 6,511,280 pounds and \$358,120; zinc, quick-silver, platinum, and iron ore also showed increases. Gold decreased from \$15,704,822 to \$14,670,346, in spite of which in 1922 California accounted for approximately 30 per cent of the gold output of the United States.

Of the structural group: brick and tile increased in value from \$5,570,875 to \$7,994,991; miscellaneous stone (comprising crushed rock, sand and gravel, paving blocks) from \$7,834,640 to \$10,377,783; magnesite, lime, marble, and onyx also increasing; cement, although increasing from 7,404,221 barrels to 8,962,135 barrels in output, decreased from \$18,072,120 to \$16,524,056 in value. Slate again joined the active list with a small yield.

In the 'industrial' group, there were a number of fluctuations, the more important increases being shown by mineral water, pottery clay, gypsum, and pyrites; and decreases by diatomaceous earth, and limestone. Two new items were added in 1922 to this list, not previously produced commercially in California, namely: shale oil and sillimanite. In the saline group, potash and soda increased, with borates, magnesium salts, salt, and calcium chloride, decreasing.

Details of the 1922 production data are published in our Bulletin 93.

The following table shows the comparative yield of mineral substances of California for 1921 and 1922 as compiled from the returns received at the State Mining Bureau, San Francisco, in answer to inquiries sent to producers:

Substance	1921		1922	
	Amount	Value	Amount	Value
Asbestos.....	410 tons	\$19,275	50 tons	\$1,800
Barytes.....	901 tons	4,809	3,370 tons	18,925
Bituminous rock.....	8,298 tons	43,192	4,624 tons	13,570
Borates.....	50,136 tons	1,096,326	139,087 tons	1,068,025
Calcium chloride.....	683 tons	22,980	(3)	(3)
Cement.....	7,404,221 bbls.	18,072,120	8,962,135 bbls.	16,524,056
Brick and tile.....		5,570,875		7,994,991
Chromite.....	347 tons	6,870	379 tons	6,334
Clay (pottery).....	225,120 tons	362,172	277,232 tons	473,184
Coal.....	12,467 tons	63,578	27,020 tons	135,100
Copper.....	12,088,053 lbs.	1,559,358	22,883,987 lbs.	3,090,582
Dolomite.....	31,195 tons	99,155	52,409 tons	114,911
Feldspar.....	4,349 tons	28,343	4,587 tons	37,109
Fuller's earth.....	1,185 tons	8,295	6,606 tons	48,756
Gems.....		10,954		1,312
Gold.....		15,704,822		14,670,346
Granite.....		725,901		676,643
Graphite.....	(2)	(2)	(3)	(3)
Gypsum.....	37,412 tons	78,875	47,084 tons	188,336
Infusorial and diatomaceous earths.....	(2)	(2)	(3)	(3)
Iron ore.....	1,970 tons	12,030	3,588 tons	18,868
Lead.....	1,149,051 lbs.	51,707	6,511,280 lbs.	358,120
Lime.....	463,534 bbls.	610,619	578,748 bbls.	671,747
Limestone.....	75,921 tons	305,912	84,382 tons	282,181
Lithia.....	(2)	(2)	(3)	(3)
Magnesite.....	47,837 tons	511,102	55,637 tons	594,665
Magnesium salts.....	4,153 tons	106,140	3,036 tons	89,788
Manganese ore.....	1,005 tons	12,210	540 tons	7,650
Marble.....	30,232 cu. ft.	98,395	38,321 cu. ft.	127,792
Mineral paint.....	446 tons	4,748	1,620 tons	13,277
Mineral water.....	3,446,278 gals.	367,476	4,276,346 gals.	486,424
Natural gas.....	67,043,797 M. cu. ft.	4,704,678	103,628,027 M. cu. ft.	6,990,030
Onyx.....	2,569 cu. ft.	1,294	10,950 cu. ft.	3,320
Petroleum.....	112,599,860 bbls.	203,138,225	138,468,222 bbls.	173,381,265
Platinum.....	613 fine oz.	58,754	795 fine oz.	90,288
Potash.....	14,806 tons	390,210	17,776 tons	584,388
Pumice and volcanic ash.....	406 tons	6,310	613 tons	4,248
Pyrites.....	110,025 tons	473,735	151,381 tons	570,425
Quicksilver.....	3,157 flasks	140,666	3,466 flasks	191,851
Salt.....	197,989 tons	832,702	223,238 tons	819,187
Sandstone.....	10,150 cu. ft.	2,112	900 cu. ft.	1,100
Shale oil.....			(3)	(3)
Silica (sand and quartz).....	10,569 tons	49,179	9,874 tons	31,016
Sillimanite.....			(3)	(3)
Silver.....		3,629,223		3,100,065
Slate.....			(3)	(3)
Soapstone and talc.....	8,752 tons	130,078	13,378 tons	197,186
Soda.....	14,828 tons	438,996	20,084 tons	573,661
Stone, miscellaneous ¹		7,834,640		10,377,783
Zinc.....	846,184 lbs.	42,309	3,034,430 lbs.	172,963
Unapportioned.....		726,122		380,558
Total values.....		\$268,157,472		\$245,183,826

(1) Recalculated to 40 per cent 'anhydrous boric acid' equivalent.

(2) Unapportioned—includes graphite, diatomaceous earth, and lithia.

(3) Unapportioned—includes calcium chloride, graphite, diatomaceous earth, lithia, shale oil, sillimanite, and slate.

(4) Includes macadam, ballast, rubble, riprap, paving blocks, sand, gravel, and grinding-mill pebbles.

The following table shows the comparative value of the mineral production of the various counties in the state, for the years 1921 and 1922:

County	1921	1922
Alameda	\$1,353,690	\$2,041,454
Alpine	925	2,800
Amador	2,368,464	2,479,063
Butte	669,830	720,625
Calaveras	1,525,201	1,502,883
Colusa	80,438	75,934
Contra Costa	1,622,732	2,397,312
Del Norte	6,029	6,261
El Dorado	112,756	184,525
Fresno	19,498,503	10,853,433
Glenn	103,197	91,250
Humboldt	138,597	125,613
Imperial	182,818	188,739
Inyo	1,460,218	2,137,681
Kern	100,840,933	68,551,002
Kings	5,722	6,806
Lake	174,389	48,289
Lassen	83,485	27,327
Los Angeles	31,704,941	62,751,671
Madera	467,667	476,264
Marin	318,776	403,099
Mariposa	342,601	226,832
Mendocino	44,722	20,526
Merced	33,550	157,579
Modoc	36,650	16,018
Mono	56,876	86,863
Monterey	170,155	255,319
Napa	195,239	312,270
Nevada	2,641,081	2,966,005
Orange	47,499,030	38,926,087
Placer	449,070	405,975
Plumas	1,798,461	3,314,498
Riverside	4,883,898	3,243,917
Sacramento	2,394,894	2,189,562
San Benito	1,386,093	1,794,248
San Bernardino	9,375,540	8,547,900
San Diego	501,393	656,807
San Francisco	41,562	65,409
San Joaquin	474,378	473,395
San Luis Obispo	129,791	141,470
San Mateo	257,092	243,984
Santa Barbara	10,190,929	4,613,358
Santa Clara	750,708	894,036
Santa Cruz	4,080,885	3,608,805
Shasta	841,262	1,513,591
Sierra	620,361	1,770,626
Siskiyou	93,147	101,463
Solano	3,030,198	3,108,114
Sonoma	175,551	221,941
Stanislaus	236,207	452,167
Sutter	54	97
Tehama	30,820	9,388
Trinity	456,882	197,937
Tulare	552,234	371,845
Tuolumne	554,483	764,938
Ventura	6,245,269	5,837,078
Yolo	14,829	13,431
Yuba	4,852,266	2,588,316
Total values	\$268,157,472	\$245,183,826

Total Mineral Production of California, by Years.

The following tabulation gives the total value of mineral production of California by years since 1887, in which year compilation of such data by the State Mining Bureau began. At the side of these figures the writer has placed the values of the most important metal and non-metal items—gold and petroleum.

In the same period copper made an important growth beginning with 1897 following the entry of the Shasta County mines, and more recently Plumas County. Cement increased rapidly from 1902, while crushed rock, sand and gravel as a group parallels the cement increase. Quicksilver has been up and down. Mineral water and salt have always been important items, but the values fluctuate. Borax has increased materially since 1896. War-time increases, 1915–1918, were shown by chromite, copper, lead, magnesite, manganese, silver, tungsten and zinc. Most of these, except silver, have since declined; with structural materials and copper increasing in 1920–1922.

Total Mineral Production of California by Years, Since 1887.

Year	Total value of all minerals	Gold, value	Petroleum, value
1887	\$19,785,868	\$13,588,614	\$1,357,144
1888	19,469,320	12,750,000	1,380,666
1889	16,681,731	11,212,913	368,048
1890	18,039,666	12,309,793	384,200
1891	18,872,413	12,728,869	401,264
1892	18,300,168	12,571,900	561,333
1893	18,811,261	12,422,811	608,092
1894	20,203,294	13,923,281	1,064,521
1895	22,844,663	15,334,317	1,000,235
1896	24,291,398	17,181,562	1,180,793
1897	25,142,441	15,871,401	1,918,269
1898	27,289,079	15,906,478	2,376,420
1899	29,313,460	15,336,031	2,660,793
1900	32,622,945	15,863,355	4,152,928
1901	34,355,981	16,989,044	2,961,102
1902	35,069,105	16,910,320	4,692,189
1903	37,759,040	16,471,264	7,313,271
1904	43,778,348	19,109,600	8,317,809
1905	43,069,227	19,197,043	9,007,820
1906	46,776,085	18,732,452	9,238,020
1907	55,697,949	16,727,928	16,783,943
1908	66,363,198	18,761,559	26,566,181
1909	82,972,209	20,237,870	32,398,187
1910	88,419,079	19,715,440	37,689,542
1911	87,497,879	19,738,908	40,552,088
1912	88,972,385	19,713,478	41,868,344
1913	98,644,639	20,406,958	48,578,014
1914	93,314,773	20,653,496	47,487,109
1915	96,663,369	22,442,296	43,503,837
1916	127,901,610	21,410,741	57,421,334
1917	161,202,962	20,087,504	86,976,209
1918	199,753,837	16,529,162	127,459,221
1919	195,830,002	16,695,955	142,610,563
1920	242,099,667	14,311,043	178,394,937
1921	268,157,472	15,704,822	203,138,225
1922	245,183,826	14,670,346	173,381,265
Totals	\$2,751,150,349	\$602,218,554	\$1,365,753,916

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections located in North America; and contains not only one or more samples of most of the known minerals found in California, but many specimens from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well as by those who utilize the facilities of the collection. The Bureau supplies a set of forty typical minerals and ores, appropriately labeled, for study purposes to any public school in the state upon request.

LABORATORY.

FRANK SANBORN, Mineral Technologist.

During the five-month period covered by this report 1584 samples were received and determined at the laboratory of the Bureau. These samples were of great variety; salines, precious metals, and gem stones being received and recorded as having a possible commercial value.

A rather large demand has been created during recent months for colored rocks suitable as a 'dash' in stucco work. To be desirable for this, the material should be hard, compact, and of a pleasing color. Red, green, yellow, and black are the colors usually desired, but there are others that would probably be suitable for such decorative work. There is the blue dumortierite and glaucophane-schist, the pistachio-green epidote and epidosite, rocks having the properties of reflecting light, such as micaceous hematite and some mica-schist. These and many other rocks and minerals if once introduced as ornamental stones in certain types of buildings, would possibly be a means by which the use of colored stones could be increased, and a market found for many rocks having no commercial value at present.

The demand for pyrite and galena making good radio crystals is still active. Sensitive crystals are worth between 50 cents and \$1 per pound at the mine. This laboratory is not equipped for making tests for sensitiveness.

LIBRARY.

FOREST L. CAMPBELL, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey :

- Bulletin No. 729—Oil Shale of the Rocky Mountain Region. By Dean C. Winchester.
- Bulletin No. 732—Geology and Ore Deposits of Shoshone County, Idaho. By Joseph B. Umpleby and E. L. Jones, Jr.
- Bulletin No. 734—Deposits of Manganese Ore in the Batesville District, Arkansas. By Hugh D. Miser.
- Bulletin No. 735-I—Diamond-Bearing Peridotite in Pike County, Arkansas. By Hugh D. Miser and Clarence S. Ross.
- Bulletin No. 735-J—The Los Burros District, Monterey County, California. By James M. Hill.
- Bulletin No. 740—Mica Deposits of the United States. By Douglas B. Starrett.
- Bulletin No. 741—The Jarbridge Mining District, Nevada. By Frank C. Schrader.
- Bulletin No. 743—Geology of the Oatman Gold District, Arizona. By F. L. Ransome.
- Bulletin No. 689—Boundaries, Areas, Geographic Centers and Altitudes of the United States and the Several States. By Edward M. Douglas.
- Bulletin No. 709—Triangulation and Primary Traverse 1916-1918. By C. H. Birdseye.
- Bulletin No. 717—Sodium Sulphate; Its Sources and Uses. By Roger C. Wells.
- Bulletin No. 718—Geology and Ore Deposits of the Creede District, Colo. By Wm. H. Emmons and Esper S. Larsen.
- Bulletin No. 738—The Commercial Granites of New England. By T. Nelson Dale.

- Bulletin No. 739—Mineral Resources of Alaska. A Report on Progress of Investigations in 1921. By A. H. Brooks and others.
- Bulletin No. 744—The Lime Belt of Massachusetts and Parts of Eastern New York and Western Connecticut. By T. Nelson Dale.
- Bulletin No. 745—The Kotsina-Kuskulana District Alaska. By Fred H. Moffit and J. H. Mertie, Jr.
- Bulletin No. 750-A—Ilesemannite at Ouray, Utah. By Frank L. Hess.
- Bulletin No. 751-B—Progress Report on a Subsurface Study of the Pershing Oil and Gas Field, Osage County, Oklahoma. By W. W. Rubey.
- Prof. Paper No. 131-F—Revision of The Flora of The Green River Formation With Descriptions of New Species. By F. H. Knowlton.
- Prof. Paper No. 131-G—Fossil Plants from the Tertiary Lake Beds of South Central Colorado. By F. H. Knowlton.
- Prof. Paper No. 131-H—The Fauna of the So-called Dakota Formation of Northern Central Colorado and Its Equivalent in Southeastern Wyoming. By John B. Reeside, Jr.
- Prof. Paper No. 132-A—Rock Formations in the Colorado Plateau of Southeastern Utah and Northern Arizona. By C. R. Longwell et al.
- Water-Supply Paper No. 488—The Floods in Central Texas in September, 1921. By C. E. Ellsworth.
- Water-Supply Paper No. 493—Hydroelectric Power Systems of California and Their Extension Into Oregon and Nevada. By Frederick Hall Fowler.
- Water-Supply Paper No. 504—Surface Water Supply of the United States, 1919-1920. Part IV—St. Lawrence River Basin. By Nathan C. Grover and others.
- Water-Supply Paper No. 496—The Industrial Utility of Public Water Supplies in the United States. By W. D. Collins.
- Water-Supply Paper No. 469—Surface Waters of Wyoming and Their Utilization. By Robert Follansbee.
- Water-Supply Paper No. 495—Geology and Ground Water Resources of Sacramento Valley, California. By Kirk Bryan.
- Water-Supply Paper No. 512—Surface Water Supply of the U. S., 1919 and 1920. Part XII—North Pacific Slope Drainage Basins. A. Pacific Basins in Washington and Upper Columbia River Basin. By Nathan C. Grover and others.
- Water-Supply Paper No. 501—Surface Water Supply of the United States, 1919-1920. Part I—North Atlantic Slope Drainage Basin. By Nathan C. Grover and others.
- Water-Supply Paper No. 510—Surface Water Supply of the United States, 1919-1920. Part X—The Great Basin. By Nathan C. Grover and others.
- Mineral Resources of the United States:
- Chromite in 1922. By Edward Sampson.
- Preliminary Summary, 1922.
- Asbestos in 1922. By Edward Sampson.
- Coke and By-products in 1921. By R. S. McBride.
- Gold, Silver, Copper, Lead and Zinc in the Eastern States in 1922. By J. P. Dunlap.
- Part 1. Metals.
- Part 1. Bismuth, Selenium, and Tellurium in 1922. By Victor C. Heickes.
- Lead in 1922. By C. E. Siebenthal and A. Stoll.
- Zinc in 1922. By C. E. Siebenthal and A. Stoll.
- Asphalt and Related Bitumens in 1922. By K. W. Cottrell.
- Part 1. Bauxite and Aluminum in 1922. By James M. Hill.
- Salt, Bromine and Calcium Chloride in 1922. By K. W. Cottrell.
- Fluorspar and Cryolite in 1922. By Hubert W. Davis.
- Antimony in 1922. By Frank C. Schrader.
- Peat in 1922. By K. W. Cottrell.
- Petroleum in 1919-1921. By G. B. Richardson.
- Lead and Zinc Pigments and Salts in 1922. By C. E. Siebenthal and A. Stoll.
- Iron Ore, Pig Iron and Steel in 1921. By Ernest F. Burchard and Hubert W. Davis.
- Fuel Briquets in 1922. By W. F. McKenney.
- Cadmium in 1922. By C. E. Siebenthal and A. Stoll.
- Natural Gas in 1919-1921. By B. S. McBride and E. G. Sievers.

- U. S. Department of Commerce, Commerce Reports April 9-16; May 7, 14, 21, 28; June 4, 1923:
 Monthly Summary of Foreign Commerce of the United States, Part II, December, 1922, and January, 1923.
 Monthly Summary of Foreign Commerce of the United States, Part II, February, 1923.
 Monthly Summary of Foreign Commerce of the United States, Part I, April, 1923.
 Monthly Summary of Foreign Commerce of the United States, Part II, March, May, June, July and August, 1923.
- U. S. Coast Geodetic Survey:
 Serial No. 216—Use of Geodetic Control for City Surveys. By Hugh C. Mitchell.
 Serial No. 225—Reconnaissance and Signal Building. By Jasper S. Bilby.
- Smithsonian Institution United States National Museum:
 Bulletin No. 100, Vol. 3—Contributions to the Biology of the Philippine Archipelago and Adjacent Regions. By Rene Koehler.
 Bulletin No. 123—Revision of The North American Moths of the Subfamily Eucosminae of the Family Olethreutidae. By Carl Heinrich.
 Bulletin No. 124—The Type Species of the Genera of Chalcididae or Chalcid-Flies. By A. B. Gahan and Margaret M. Fagen.
- Smithsonian Institution, Annual Report, 1921:
 U. S. National Museum—Bulletin No. 102, Part 8, Manufactured Gas in the Home. By Samuel S. Wyer.
 U. S. National Museum—Proceedings of the United States National Museum. Vol. 61.
 U. S. National Museum—Bulletin No. 126, Life Histories of North American Wild Fowl. By Arthur Cleveland Bent.
 Bulletin No. 120—The Opolinid Ciliate Infusorians. By Maynard M. Metcalf.
 Bulletin No. 125—North American Later Tertiary and Quarternary. By Ferdinand Canu and Ray S. Bassler.
 Trees and Shrubs of Mexico. By Paul C. Standley.
 Catalogue of the Watercraft Collection in the United States National Museum. By Carl W. Mitman.
- U. S. Bureau of Mines:
 Bulletin No. 211—The Chloride Volatilization Process of Ore Treatment. By Thomas Varley and Robert H. Bradford, E. P. Barrett and C. C. Stevenson.
 Bulletin No. 213—Talc and Soapstone, Their Mining, Milling, Products and Uses. By Raymond B. Ladoo.
 Bulletin No. 216—Bibliography of Petroleum and Allied Substances in 1919-1920. By E. H. Burroughs.
 Bulletin No. 217—Preparation, Treatment and Combustion of Powdered Coal. By John Blizard.
 Bulletin No. 204—Underground Ventilation at Butte. By D. Harrington.
 Bulletin No. 219—Explosives, Their Materials, Constitution and Analysis. By C. A. Taylor and Wm. H. Rinkenbach.
 Technical Paper No. 300—The Universal and the Fireman's Gas Masks. By S. H. Katz, J. J. Bloomfield and A. C. Fieldner.
 Technical Paper No. 331—Metal Mine Accidents in the United States During the Calendar Year 1921. By William W. Adams.
 Technical Paper No. 328—The Motor Gasoline Surveys of 1920 and 1921. By N. A. C. Smith.
 Technical Paper No. 326—Fire in Steamship Bunker and Cargo Coal. By H. H. Soek.
 Technical Paper No. 333—Permissible Explosives, Mining Equipment and Apparatus Approved Prior to January 1, 1923. By S. P. Howell et al.
 Technical Paper No. 334—Mine Rescue Standards. A Tentative Study.
 Technical Paper No. 339—Coal Mine Fatalities in the United States, 1922. By William W. Adams.

- Technical Paper No. 340—Production of Explosives in the United States during the Calendar Year 1922. By William W. Adams.
- Technical Paper No. 283—Tests of Low Grade and Complex Ores in Colorado. By Will H. Coghill and C. O. Anderson.
- Technical Paper No. 294—Progress of Investigations on Liquid-Oxygen Explosives. By S. P. Howell et al.
- Technical Paper No. 315—Comparative Tests of By-Product Coke and Other Fuels for House-Heating Boilers. By Henry Kreisinger et al.
- Technical Paper No. 321—Anhydrous Aluminum Chloride. By Oliver C. Ralston.

Reports of Investigations:

- Serial No. 2462—The Treatment of Natural-Gas Gasoline to Meet the Doctor Test. By D. B. Dow (Associate Organic Chemist, B. M.).
- Serial No. 2463—Utilization of Waste Rock at Lime Plants. By Oliver Bowles (Mineral Technologist, B. M.).
- Serial No. 2464—Physiological Effect of High Temperatures and Humidities With and Without Air Movement. By R. R. Sayers (Chief Surgeon, U. S. B. M., Surgeon U. S. Public Health Service) and D. Harrington (Supervising Mining Engineer, B. M.).
- Serial No. 2465—Mine Timber in Illinois Coal Mines. By Harry E. Tufft (Mining Engineer, U. S. B. M.).
- Serial No. 2466—An Economic Study of the New Albany Shale. By John R. Reeves (Department of Geology, Indiana University).
- Serial No. 2467—Additions, Removals and Changes in Permissible List of Explosives from December 31, 1922, to March 15, 1923. By S. P. Howell (Explosives Engineer, B. M.).
- Serial No. 2468—Monel Metal as a Material for Flame Safety Lamp Gauzes. By A. B. Hooker (Assistant Electrical Engineer, B. M.), and R. A. Kearns (Junior Electrical Engineer, B. M.).
- Serial No. 2469—The Desulphurization of Coke by Air. By Alfred R. Powell (Associate Chemist, Pittsburgh Experiment Station, B. M., Department of the Interior).
- Serial No. 2470—Combustion of Powdered Coal. By Henry Kreisinger (Research Engineer, Combustion Engineering Corp.) and John Blizzard (Fuel Engineer, U. S. B. M.).
- Serial No. 2471—Explosives Used in February, 1923. By W. W. Adams (Statistician, B. M.).
- Serial No. 2472—Coal Mine Fatalities in March, 1923. By W. W. Adams (S. B. M.).
- Serial No. 2473—Globe-Miami Mine Rescue Maneuvers. By E. D. Gardner (Mining Engineer, Department of the Interior, Bureau of Mines).
- Serial No. 2474—Approval System of the Interior Department, Bureau of Mines, as Applied to Permissible Storage-Battery Locomotives. (Second Complete Investigation under Schedule 15.) By L. C. Hlsley (Electrical Engineer, Pittsburgh Experiment Station, Department of the Interior, Bureau of Mines) and H. B. Brunot (Junior Electrical Engineer, Pittsburgh Experiment Station, Department of the Interior, Bureau of Mines).
- Serial No. 2475—The Metallurgical Treatment of Zinc Retort Residues. By B. M. O'Harra (Associate Metallurgist, Department of the Interior, Bureau of Mines).
- Serial No. 2476—Dangers of and Treatment for Carbon Monoxide Poisoning. By R. R. Sayers (Chief Surgeon of Bureau of Mines, Department of the Interior, and Surgeon of Public Health Service, Treasury Department), and W. P. Yant (Associate Chemist, Pittsburgh Experiment Station of Bureau of Mines, Department of the Interior).
- Serial No. 2477—Barite and Ocher in the Cartersville, Georgia, District. By W. M. Weigel (Mineral Technologist of the Bureau of Mines, Department of the Interior).
- Serial No. 2478—Explosives Used in March, 1923. By W. W. Adams (Statistician, Bureau of Mines).
- Serial No. 2479—Quarrying to Obtain a Uniform Lime Product. By Oliver Bowles (Mineral Technologist, Bureau of Mines).
- Serial No. 2480—Fluorspar Mining in the Western States. By Raymond B. Ladoo (Mineral Technologist, U. S. Bureau of Mines).

- Serial No. 2481—Explosion-Proof Coal-Cutting Equipments Approved Prior to January 1, 1923 (Supplementary to Bulletin 78). By E. J. Gleim (Associate Electrical Engineer, Pittsburg Experiment Station, U. S. Bureau of Mines).
- Serial No. 2482—Survey of Pacific Coast Petroleum Products. Part 2. Lubricating Oils. By Earl C. Lane (Assistant Chemist, Bureau of Mines) and N. F. LeJeune (Assistant Chemist, Bureau of Mines).
- Serial No. 2483—Coal Mine Fatalities in April, 1923. By W. W. Adams (Statistician, Bureau of Mines).
- Serial No. 2484—Why Not Scrap 'The Davy'? By J. W. Paul and A. B. Hooker.
- Serial No. 2485—The Reduction of Iron Oxides by Fuel Gases. By E. D. Eastman.
- Serial No. 2486—The Pyro Tannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and Air. By R. R. Sayers, W. P. Yant, and G. W. Jones.
- Serial No. 2487—Gasoline Saved on Government Trucks by Adjusting Carburetors by Exhaust Gas Analysis. By G. W. Jones and A. C. Fieldner.
- Serial No. 2488—Who May Set Off Blasts in Coal Mines? By L. C. Ilsley.
- Serial No. 2489—Comparison of Gas Masks, Hose Masks, and Oxygen-Breathing Apparatus. By S. H. Katz and J. J. Bloomfield.
- Serial No. 2490—Explosives Used in April, 1923. By W. W. Adams.
- Serial No. 2491—Hydrogen Sulphide as an Industrial Poison. By R. R. Sayers, C. W. Mitchell and W. P. Yant.
- Serial No. 2492—Results of Assays of the New Albany Oil-Shale. By John R. Reeves.
- Serial No. 2493—The Wheat Electric Cap Lamp, Approval No. 17. By L. C. Ilsley and A. B. Hooker.
- Serial No. 2494—Atmospheric Conditions and Physiological Effects Produced on Trainmen by Locomotive Smoke in the Aspen and the Wahsatch Tunnels of the Union Pacific Railroad. By S. P. Kinney.
- Serial No. 2495—Coal Mine Fatalities in May, 1923. By W. W. Adams.
- Serial No. 2496—Platinum Assays and Platinum Promotions. By S. C. Lind, C. W. Davis and M. W. von Bernewitz.
- Serial No. 2497—Gases Liberated by High-Voltage Insulator Testing Apparatus. By G. W. Jones and W. P. Yant.
- Serial No. 2498—Disastrous Inflammation of Coal Dust in Excavating a Mine Dump. By C. A. Herbert.
- Serial No. 2499—Carbon Tetrachloride Extinguisher on Electric Fires. By S. H. Katz, E. J. Gleim and J. J. Bloomfield.
- Serial No. 2500—The 'Model E' Edison Electric Cap Lamp. Approval No. 18. By L. C. Ilsley and A. B. Hooker.
- Serial No. 2501—Explosives Used in May, 1923. By W. W. Adams.
- Serial No. 2502—The Use of Oxygen or Oxygenated Air in Metallurgical and Allied Processes. By F. W. Davis.
- Serial No. 2503—Some General Considerations of the Gummy Meter Problem in the Gas Industry. By Ralph L. Brown.
- Serial No. 2504—Test Papers for Estimating Hydrocyanic Acid Gas in Air. By S. H. Katz and E. S. Longfellow.
- Serial No. 2505—Sulphur Trioxide Smoke Tubes for Determining Air Currents. By S. H. Katz and J. J. Bloomfield.
- Serial No. 2506—Field Investigation on Trailing Cables Used on Coal-Cutting Outfits. By L. C. Ilsley and H. B. Freeman.
- Serial No. 2507—Oxygen-Oil Explosions. By Mayo D. Hersey.
- Serial No. 2508—Coal Mine Fatalities in June, 1923. By W. W. Adams.
- Serial No. 2509—Experiments on Fan-Pipe Installations at Butte, Montana. By G. E. McElroy and A. S. Richardson.

State of California, Department of Public Works:

- Bulletin No. 1—Hydrographic Investigation of San Joaquin River.
- Bulletin No. 4—Water Resources of California.
- Bulletin No. 5—Flow in California Streams.
- Bulletin No. 6—Irrigation Requirements of California Lands.
- First Biennial Report of the Department of Public Works, State of California, 1922.

State of California, Board of Forestry :

Circular No. 7—The Forest Situation in California in 1923.

Twentieth Biennial Report of the Bureau of Labor Statistics of the State of California, 1921–1922.

Geological Survey of Alabama, County Report No. 1—Geology and Mineral Resources of Clay County. By William Frederick Prouty.

Geological Survey of Georgia, Bulletin No. 40—Oil and Gas in Georgia. By T. M. Prettyman and H. S. Cave.

State of Colorado, Bureau of Mines, Annual Report, 1922.

Bureau of Mines and Geology, Idaho, Pamphlet No. 6—A Preliminary Study of Certain Reported Platinum Occurrences Near Coeur D'Alene, Idaho.

Pamphlet No. 5—Reconnaissance :

A Preliminary Reconnaissance of the Gas and Oil Possibilities of South-eastern and South-Central Idaho. By John P. Buwalda.

Iowa Geological Survey, Vol. XXVIII—Gypsum.

Kentucky Geological Survey, Geology of the Princeton Quadrangle. By Stuart Weller.

Kentucky Geological Society—The Geography of the Jackson Purchase. By Darrell Haug Davis.

Mississippi State Geological Survey, Bulletin No. 18—A Questionnaire on the Mineral Resources of Mississippi and the Work of the State Geological Survey. By E. N. Lowe, State Geologist.

North Carolina Geological and Economic Survey, Circular No. 7—Forest Fires and the Boll-Weevil. By Fred B. Merrill.

Circular No. 8—North Carolina Drainage Law.

Circular No. 5—Amendments to the North Carolina Drainage Law. Passed by the General Assemblies of 1921 and 1923.

Circular No. 6—The Water Power Situation in North Carolina. By Thorndike Saville.

Commonwealth of Pennsylvania :

Bulletin No. 71—Copper Ores in Pennsylvania. By J. Ross Corbin.

Bulletin No. 72—Flagstone Industry in Northeastern Pennsylvania. By R. W. Stone.

Bulletin No. 73—Oil and Gas Sands in the North Half of the Pittsburgh Quadrangle, Penn. By M. E. Johnson.

Bulletin No. 74—Chromite in Pennsylvania. By J. Ross Corbin.

Bulletin No. 75—Rocks of the Quarryville Quadrangle. By Anna I. Jones.

Bulletin No. 76—Calcareous Marl in Pennsylvania, South of the Terminal Moraine. By J. B. R. Dickey.

Bulletin No. 77—Gold in Pennsylvania. By J. Ross Corbin.

South Dakota Geological and Natural History Survey, Circular No. 13—The Possibilities of Oil in Northern Ziebach County. By Roy A. Wilson and Freeman Ward.

Circular No. 11—Trees and Shrubs of South Dakota. By William H. Over.

Circular No. 12—Possibilities of Oil in Eastern Harding County. By W. C. Toepelman.

Circular 10—Possibilities of Oil in Northern Dewey County.

Division of Mines, Tennessee—Twenty-eighth Annual Report of the Mineral Resources of Tennessee.

Division of Geology, Tennessee, Bulletin No. 27—Administrative Report of the State Geologist, 1921–1922.

University of Texas, Bulletin No. 2234—Report on Texas Alkali Lakes. By C. C. Meigs, H. P. Bassett and G. B. Slaughter.

State College of Washington—The Clays of the State of Washington. Their Geology, Mineralogy and Technology. By Solon Shedd, Assistant State Geologist.

West Virginia Geological Survey—County Reports, 1923, and accompanying maps. Mine Inspector to the Governor of Alaska, Annual Report, 1922.

Department of the Interior of Canada—Natural Resources of the Prairie Provinces.

- Department of Colonization, Mines and Fisheries, Quebec, Canada—Report on Mining Operations in the Province of Quebec for the Year 1922.
- Department of Mines, Ontario, Bulletin No. 46—Hydro-Electric Development for Gold and Silver Mines of Northern Ontario. By A. R. Webster.
- Bulletin No. 48—The South Lorraine Silver Area. By Cyril W. Knight.
- Canada Department of Mines, Mines Branch—Summary Report of Investigations Made by the Mines Branch During the Calendar Year Ending December 31, 1921.
- Dominion Fuel Board, Canada, Interim Report, 1923.
- Department of Mines, Canada—Silica in Canada, Its Occurrence, Exploitation and Uses. Part I—Eastern Canada.
- Scientific and Industrial Research Council of Alberta—Third Annual Report, 1922.
- Ontario Department of Mines—Thirtieth Annual Report, 1921.
- Ontario Department of Mines—Thirty-first Annual Report, 1922.
- New Zealand Department of Mines, Geological Survey Branch, Bulletin No. 24—The Geology of the Mokau Subdivision.
- New South Wales, Department of Mines, Geological Survey, Bulletin No. 2—Silver, Lead, Zinc. By E. J. Kenny.
- Mineral Resources of Alberta—Fourth Annual Report, 1922. Part I—Saunders Creek and Nordegg Coal Basins, Alberta, Canada. Part II—An Occurrence of Iron on Lake Athabaska.
- Departamento de Minas, Mexico—Boletino Minero, October, 1922.
- Boletino Minero, November, 1922.
- Departamento de Petroleo, Mexico—Boletin of Petroleo, Vol. XV, Num. 1.
- Instituto Geologico de Mexico, Boletin Num. 39—Exploracion en la Peninsula de Baja California Por la Comision Explorada del Pacifico.
- Departamento de Minas, Mexico—Boletin Minero Tomo XIV, Numero 6.
- Secretaria de Industria, Comercio y Trabajo Instituto Geologico de Mexico, Boletin Num. 38—Memoria Relativa al Terremoto Mexicano del 3 de Enero de 1920.
- Secretaria de Industria, Comercio y Trabajo, Boletin del Petroleo, September, October and December, 1922.
- The Transvaal Chamber of Mines, Monthly Analysis of Gold Production in the Transvaal, May, 1923.
- Geological Survey of Victoria:
- Cudgewa, County of Benambra.
- Yinnar, County of Buln Buln.
- Royal Society of New South Wales—Journal and Proceedings of the Royal Society of New South Wales for 1921. Vol. IV.
- Department of Mines, South America—Mining Review for the Half-Year Ending December 31, 1922. No. 37.
- Queensland Geological Survey—Paleozoic Floras of Queensland. Part I. The Flora of the Lower and Upper Bowen Series. By A. B. Walker, D. Sc., Secretary of Linnean Society of New South Wales.
- Department of Mines, New South Wales—Annual Report, 1922.
- Bulletin No. 3—Copper. By E. J. Kenny.
- New Zealand Department of Mines, Bulletin No. 25—The Geology and Mineral Resources of the Collingwood Subdivision, Karamea Division. By M. Ongley and E. O. Macpherson.
- Geological Survey of Western Australia—Annual Progress Report for 1922.
- The Deputy Master and Comptroller of the Royal Mint, London—Fifty-first and Fifty-second Annual Reports, 1920–1921.
- Imperial Geological Survey, Japan—Industrial Mineral Survey Report. Nos. 13–19, inclusive.
- Its History, Organization and Work.
- Bulletin Vol. XXVI, Number 1.
- Tohoku Imperial University, Japan, Vol. I, No. 3—The Science Reports of Petrology, Mineralogy and Economic Geology.
- Extract from Journal Geological Society Tokyo, Vol. XXX—Cretaceous Trigoniea from Amakusa Islands, Prov. Higo, Kyushu, Japan. By S. Yehara, Rigakushi.
- Ministerio de Fomento of Peru, Boletin No. 105—Estadistica Industrial del Peru
- Boletin No. 106—Estadistica Minera on 1921.

Societies and Educational Institutions.

- The American Mineralogist. March, April and May, 1923.
 Australian Institute of Mining and Metallurgy—Proceedings. September 30, 1922.
 Bulletin of the National Research Council. April, 1923.
 Canadian Institute of Mining and Metallurgy. April, May and June, 1923.
 Alumni Magazine of the Colorado School of Mines. March, April and May, 1923.
 Economic Geology. March, April and May, 1923.
 Mining and Metallurgy. January, February and March, 1923.
 Bulletin of the Institution of Mining and Metallurgy. March, April and May, 1923.
 The Geographical Review. April, 1923.
 The Journal of Geology. March, April and May, 1923.
 Journal of the American Peat Society. April, 1923.
 Journal of the College of Science, Imperial University of Tokyo. March 31, 1923.
 Journal of the Western Society of Engineers. April and May, 1923.
 Archivos de la Asociacion Peruana para el Progreso de la Ciencia. Ano, 1922.
 Lima.
 Memorias de la Real Academia de Ciencias y Artes. Vol. XVII. Num. 22. El Barografo de Mercurio de la Estacion Sismologica de Cartuja (Granada). Por El. R. R. Manuel M. S. Navarro-Neumann, S. J.
 Memorias de la Real Academia de Ciencias y Artes. Vol. XVII. Num. 16. La Tierra de Labor. Por El Academico Numerario. Dr. D. Casimiro Brugues y Escuder.
 Vol. XVII. Num. 17. Algunas Consideraciones Sobre Un Grupo de Cubicas. Por el Academico Numerario. Dr. Isidro Polit y Buxareu.
 Vol. XVII. Num. 18. La Conductibilidad del Suerpo Humano a las Corrientes de Alta Frecuencia En Su Modalidad de Termopenetracion O Diatermia. Por el Academico Numerario. Dr. D. Luis Cirera Salse.
 Memorias de la Real Academia de Ciencias y Artes de Barcelona. Vol. XVII. Num. 19. De Agrologia la Arcilla Coloide. Por el Academico Numerario. Dr. D. Casimiro Brugues y Escuder.
 Vol. XVII. Num. 20. Nota Sobre el Empleo del Cloruro Cesico en Microquimica. Por el Academico Correspondiente. Dr. D. E. Herrero Ducloux, Dr. D. Eugenio Mascarenas y Hernandez.
 Vol. XVII. Num. 21. Evolucion Historica de la Medicina. Por el Academico Numerario. Prof. D. Ignacio Valenti Vivo. Capitulo IV—Contemporaneidad. Seccion IV—Eugenica.
 Memoirs of the College of Science and Engineering, Wasenda Impoversotu, Tokyo, Japan.
 On the Joban Coal Field. By S. Tokunaga.
 The University of Minnesota Bulletin No. 18—The Foundry Sands of Minnesota. By G. N. Knapp.
 The Mining Congress Journal. April and May, 1923.
 Mining and Metallurgical Society of America. January, February, March and April, 1923.
 The Philippine Journal of Science. February through May, 1923.
 Proceedings of the American Philosophical Society. Vol. LXII. No. 1.
 Proceedings of the Engineers' Society of Western Pennsylvania. Vol. 38. No. 10.
 Records of the Australian Museum. Vol. XIV. No. 1.
 The Science Reports of the Tohoku Imperial University, Sendai, Japan, Second Series. Vol. VI. No. 2.
 Transactions of the American Institute of Mining and Metallurgical Engineers. Vol. LXVIII.
 Directory of the American Institute of Mining and Metallurgical Engineers.
 University of Southern California—Check List of the Geologic Formation Names of California. By Gilbert Ellis Bailey.
 The Chicago Academy of Sciences—The Higher Fungi of the Chicago Region. By Dr. Will Sayer Moffatt.
 Part II. The Gastromycetes.
 State University of New Mexico, Bulletin No. 112—Oil and Gas in New Mexico in 1923. By Robert W. Ellis.

Minnesota School of Mines, Experiment Station—The Bulletin of the University of Minnesota—Mining Directory of Minnesota for 1923. Vol. XXVI. May 21, 1923.

Australasian Inst. of Mining and Metallurgy, Inc. No. 48, Proceedings.
Mining and Metallurgical Society of America. Bulletin No. 161.

Books.

Lehrbuch Der Praktischen Geologie von Konrad Keilhack Vierte Auflage. Zweibande. I Band, II Band. Ferdinand Enke in Stuttgart.
American Petroleum Refining. By H. S. Bell.
The Nitrogen Industry. By Partington and Parker.
Inorganic Chemical Synonyms. By Elton Richmond Darling.
Year Book of the American Bureau of Metal Statistics, Third Annual Issue, 1922.
Oil Trade Blue Book.
The Engineering Index for 1922.
Brick and Clay Record—101 Ideas for Improving the Clay Plant.

Maps.

U. S. Geol. Survey—Map Showing the Oil and Gas Fields of the State of California.

U. S. Geol. Survey Topographic Sheets:

Sawyers Bar, Cal.	Fresno, Cal.
Firebaugh, Cal.	Hess Canyon, Tex.
Tranquillity, Cal.	Joliet, Ill.
Jamesan, Cal.	Little Panoche, Cal.
Gravel Ford, Cal.	Livingston Manor, N. Y.
Conejo, Cal.	Lock Haven, Pa.
Selma, Cal.	Meridian, Miss.
Academy, Cal.	Pocono, Pa.
Armstrong, Tex.	Rockville, Md.-Va.
Barrington, Ill.	Sanger, Cal.
Chillicothe, Mo.	Stark, N. Y.
Fort Dodge, Iowa.	Sultan, Wash.
Fort Stockton, Tex.	Williamsport, Pa.

Geological Map of Tennessee, State Geological Department of Tennessee.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.
Architect and Engineer, San Francisco.
Arizona Mining Journal, Phoenix, Arizona.
Asbestos, Philadelphia, Pennsylvania.
Brick and Clay Record, Chicago.
Cement, Mill and Quarry, Chicago, Illinois.
Chemical Engineering and Mining Review, London, England.
Engineering and Mining Journal-Press, New York.
Financial Insurance News, Los Angeles, California.
Graphite, Jersey City.
Journal of Electricity and Western Industry, San Francisco.
Metallurgical and Chemical Engineering, New York.
Mining and Engineering Record, Vancouver, B. C.
Mining and Oil Bulletin, Los Angeles.
Oil Age, Los Angeles.
Oil and Gas Journal, Tulsa, Oklahoma.
Oil News, Galesburg, Illinois.
Oildom, New York.
Oil, Paint and Drug Reporter, New York.
Oil Trade Journal, New York.
Oil Weekly, Houston, Texas.
Petroleum Age, New York.
Petroleum Record, Los Angeles.

Petroleum World, Los Angeles.
 Queensland Government Mining Journal, Brisbane, Australia.
 Rock Products, Chicago, Illinois.
 Safety News, Industrial Accident Commission, San Francisco.
 Salt Lake Mining Review, Salt Lake City, Utah.
 Southwest Builder and Contractor, Los Angeles.
 Standard Oil Bulletin, San Francisco.
 Stone, New York.
 The Record, Associated Oil Company, San Francisco.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.
 Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).
 Bakersfield Morning Echo, Bakersfield, Cal.
 Blythe Herald, Blythe, Cal.
 Bridgeport-Chronicle-Union, Bridgeport, Mono Co., Cal.
 California Oil World, Los Angeles, Cal.
 Colusa Daily Sun, Colusa, Cal.
 Daily Commercial News, San Francisco, Cal.
 Daily Midway Driller, Taft, Cal.
 Del Norte Triplicate, Crescent City, Cal.
 Gateway Gazette, Beaumont, Cal.
 Goldfield News, Goldfield, Nevada.
 Guerneville Times, Guerneville, Cal.
 Healdsburg Enterprise, Healdsburg, Cal.
 Humboldt Standard, Eureka, Cal.
 Inyo Independent, Independence, Cal.
 Inyo Register, Bishop, Cal.
 Kern County Progress, Shafter, Cal.
 Lake County Bee, Lakeport, Cal.
 Mariposa Gazette, Mariposa, Cal.
 Mining and Financial Record, Denver, Colo.
 Mining Topics, Sacramento, Cal., and Unionville, Nev.
 Mountain Democrat, Placerville, Cal.
 Mountain Messenger, Downieville, Cal.
 Nevada Mining Press, Reno, Nevada.
 Oatman Mining Press, Oatman, Arizona.
 Oregon Observer, Grants Pass, Oregon.
 Oroville Daily Register, Oroville, Cal.
 Petroleum Reporter, Etna Mills, Cal.
 Placer Herald, Auburn, Cal.
 Plumas Independent, Quincy, Cal.
 Plumas National Bulletin, Quincy, Cal.
 San Diego News, San Diego, Cal.
 Santa Barbara Daily News, Santa Barbara, Cal.
 Shasta Courier, Redding, Cal.
 Siskiyou News, Yreka, Cal.
 Stockton Record, Stockton, Cal.
 Tuolumne Prospector, Tuolumne, Cal.
 Ventura Daily Post, Ventura, Cal.
 Weekly Trinity Journal, Weaverville, Cal.
 Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

Since the publication of *MINING IN CALIFORNIA* was begun, current inquiries from buyers and sellers have been summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to their quarterly publication in *MINING IN CALIFORNIA*, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.' Those on the mailing list for *MINING IN CALIFORNIA* will receive the monthly 'Commercial Mineral Notes' as well.

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

- 11- 9 Mining Engineer or Geologist. Education, School of Mines, Liege, Belgium, and Royal School of Mines, London. Three years' experience on European Geological Surveys. Speaks English, French, Greek, Bulgarian and Russian fluently, and some German. Salary open—moderate to start.
- 11-10 Any mining. Twenty years' experience as Chief Engineer, Mine Captain and Second Engineer, South Africa and West Africa fields. Age 40. Married. Salary, open.
- 11-11 Superintendent Mill or Mine. Technical education; sixteen years general experience as miner, assayer, foreman and superintendent of concentrating, amalgamating and cyaniding mills, etc.; also designing and erecting. Will go anywhere in western U. S. A. Age 48. Married. References. Salary wanted, \$225, minimum.
- 11-12 Development Service. For companies not requiring full time engineer. Underground surveys; mine mapping; preparing stope sheets and assay plans; mine records, tonnage reports; cost estimates; reports on properties, and other engineering service.
- 11-13 Superintendent. Five years' experience. Specialty, installation and operation of quicksilver ore reduction plants. Age 39. Married. References. Salary, open.
- 11-14 Superintendent, Placer Mine. Twenty years' experience. Can do surveying. Age 46. Married. References. Salary wanted, \$180 minimum.
- 11-15 Mining Engineer. Experience—various positions from miner to superintendent, since 1906. Age 41. Married. References. Salary wanted, \$300.
- 11-16 Executive or Assistant Manager. Graduate University of Copenhagen. Two years with Nogadi Soda Co., Ltd., Br. East Africa. Age 27. Single. References. Salary wanted, \$200.
- 11-17 Assayer. Eleven years' experience. Three years with last company. Age 45. Single. References. Salary, open.
- 11-18 Position in Pottery Industry. Eighteen years' experience as foreman and superintendent of plants, including much statistical, efficiency, production, selling and factory cost accounting. Age 39. Married. References. Moderate salary.
- 11-19 Working Mine Superintendent. Twenty-five years' general mining experience in Arizona, Colorado and California. First-class references.
- 11-20 Geologist. Two years' experience, laboratory and field. Age 25. Single. Salary wanted, start, \$130. References.
- 11-21 Operating Mine or Quarry. Seven years' experience in Mexico and the United States. Age 34. Married. Salary wanted, \$250 up. References.
- 11-22 Plane Table Man or Assistant to Oil Geologist. Technical graduate. Several years' experience in underground and surface surveying, field geology and paleontology. World War veteran. Salary, open.

INDEX FOR REPORT XIX.

	Page
Administrative Division	227-228
Changes in personnel.....	228
Drafting room	228
Mails and files.....	228
New district office.....	227
New publications	227
Afterthought Mine	8
Mining Company	8-13
Agricultural Minerals Act.....	225
Akers Group of mines.....	55
Alabama claim	19, 74, 145
Alberhill Coal and Clay Company, Clay deposits of.....	185-210
Allanite in California.....	79
Allison Ranch Mine.....	74
Aluminum, 1922 statistics.....	111
Alvord Mine	63
Amador County:	
Clay in	94
Coal in	96
Exploitation in	73
Mining activities in.....	94
Quartz mining in.....	13-16
Amador Kaolin Company.....	95
Amalie Mining District.....	156
Amargosa Talc Company.....	98
American Bar Quartz claims.....	141
Canadian Corporation	32
Gold Dredging Company.....	9
-Italian Hydraulic Mining Company.....	10, 139
Magnesium Company	31
Manganese Products Company.....	24
Mine	135
Trona Company	31, 32
Zinc, Lead and Smelting Company.....	57, 90
Amick property, W. D.....	95
Analyses of:	
Clay from Los Angeles County.....	165
Coal	147-149, 153, 210
Limestone from McCloud River deposit, Shasta County.....	70
Oil shale and by-products.....	213, 214, 215
Salt from Monterey Bay Salt Company.....	60
Shale from Shasta County deposit.....	71
Angels Mining Company.....	17
Antimony, 1922 statistics.....	112
Apex Mine	18
App Mine	144
Argonaut Mine	13, 143
Arlington Group	30
Arps Group of mines.....	89
Arsenic, 1922 statistics.....	112
Asbestos in Auburn Field Division.....	20
in Shasta County.....	7, 138
in Siskiyou County.....	7
in Trinity County.....	7
Group of mines.....	138
Atascadero Mining Company.....	8
Auburn Field Division.....	13, 59, 94, 140
Condition of mining in the Auburn district, 1922.....	13-21
Structural and industrial minerals of.....	19
Bacon and Bacon property.....	95
Balaklala Mines	8
Bald Mountain Mine	23
Baltic Mine	30
Banner and Jefferson Consolidated Mine.....	10
Barton, H. J.....	93
Barytes in Auburn Field Division.....	20
in Shasta County.....	7
statistics, 1922	113
Bateson, Chas. E. W., cited.....	158

Bauxite (see Aluminum).	Page
Belmont Shawmut Mine.....	19
Ben Bull Mine.....	11
Bernal Marl Fertilizer Company.....	24
Bernardi Mine.....	18
Big Buzzard Mine.....	141
Big Four Mine.....	10
Big Gold Mine.....	166
Big Joe Hydraulic Mine.....	10
Bishop Community Gold Producers Mining Company.....	23
Bishop Estate Company.....	18
Bismuth, 1922 statistics.....	114
Black Bear Hydraulic Mine.....	10
Black Hawk Mine.....	30, 166
(See also Pittsburg Mount Shasta Mining and Milling Company.)	
Blair Mine (see Triple Lode Mine).	
Blue Eyes Property.....	141
Blue Ledge Mine.....	8
Blue Light Mining Company.....	165
Blue Nose Mine.....	10
Bobbie Mining Company.....	22
Bonanza Mine.....	11
Boswell Mine.....	11
Bradley, Walter W.....	79, 108, 111, 227, 229
Brick and tile in Auburn Field Division.....	19
Brogan, Jas. S., and R. R. Norton, Asbestos deposit of.....	26
Brown Bear Mine.....	11
Brownie Group.....	23
Buckskin Mine.....	10
Bullion Hill Mining Company.....	17
Bully Boy Group.....	171
Hill Mine (see Shasta Zinc and Copper Company).	
Bunker Hill Mine.....	15
Burns Hydraulic Mine.....	10
B. V. D. Mining Company.....	22
Cabode Mine.....	58
Cadmium, 1922 statistics.....	114
Calaveras Copper Company.....	18
Calaveras County, mining in.....	16, 143
Group (see Carson Hill Gold Mines, Inc.).	
California Asbestos Mining Company.....	26
Bi-Metallic Corporation.....	13, 136
Granite Company.....	26
Graphite Company.....	31
Gypsum Corporation.....	154
Oil Corporation.....	32
Pottery Company.....	25, 94
Rand Silver, Inc.....	30, 61, 98, 167, 170
Campbell, Forest L.....	234
Camp Carbon Coal Mine.....	150
Carbon Company.....	154
Carbonate Mine.....	30
Carlile property, Mrs. W. W.....	96
Carson Hill Gold Mines, Inc.....	16
Casa Diablo Mine.....	23
Madera prospect.....	
Casey Hydraulic Mine.....	10
Catalina Island Quarry.....	98
Celite Products Company.....	31
Central Eureka Mining Company.....	15
Cerro Gordo Mines Company.....	30
Changes in Personnel.....	110, 228
Chemung Mine.....	23
Chicago-Pacific Clay Deposit.....	164
Chileno Mine.....	19, 144
Chromite in Auburn Field Division.....	20
in Del Norte County.....	
in Shasta County.....	
in Siskiyou County.....	
Clark and Sons, N.....	94, 96
Clay deposits of the Alberhill Coal and Clay Company.....	185-210
Extent and Commercial development.....	
General Geology.....	

	Page
Clay deposits of the Alberhill Coal and Clay Company—Continued.	
Geological Section of Alberhill deposit	196
Individual clays and analyses	198
Location	185
Methods of mining	193
Products in Auburn Field Division	20, 94
in Los Angeles County	164
Clays, Analyses of clays from Alberhill deposit	198, 199, 201, 203, 205, 207, 208, 209
Climax Mine	12, 13
Clio Mine	19
Coal, Analyses of	147, 148, 149, 153, 210
in Amador County	96
in Humboldt County	8
in Mendocino County	145-154
Camp Carbon Mine	150
Development	149
Historical	145
in Shasta County	8
in Siskiyou County	8
in Trinity County	8
Cobalt, 1922 statistics	115
Collom, R. E.	33, 65, 101, 174
Colma Copper Group	57, 90
Columbus Mine	18
Comanche Mine	23
Comet Mine	18
Commercial Mineral Notes	228, 244
Commonwealth Club of San Francisco	27
Condition of mining in the Auburn district, 1922	13-21
Consolidated Exploration and Development Company	24
Manganese Company	21
Consumers and Producers (see Producers and Consumers).	
Conszetti Mine	10
Continental Mine	13
Cooney, E.	46, 81, 128
Coplatzi Quarry	25
Copper Basin Consolidated Mines Company	99
Hill Mine	8
in Shasta County	8
in Siskiyou County	8
Corona Copper Mine	135
Costs, Carson Hill Gold Mines, Inc.	17
North Star Mines	140
Coyote Mine (see Randsburg Silver Mining Company).	
Craycroft and Knight	94
Crescent and Green Mountain Mines	73
Crystalline Mine	19, 74, 145
Cub Bear Mine	11
Dakin Company, F. H.	56
Dannenbrink Hydraulic Mine	10, 59
Darwin Leasing Company	30
Davis Consolidated Hydraulic Mine	10
Dawson Mine	24
Day Company Shale oil plant	216
Shale Process	216
Deer Creek Silver Mining Company	23
Desert Queen Mines	160
Diana Development Company	23
Diatomaceous Earth (see Infusorial and Diatomaceous Earth).	
Distribution of Publications	41, 77, 109
District Reports of Mining Engineers	7, 55, 89, 135
Auburn Field Division	13, 59, 94, 140
Los Angeles Field Division	29, 61, 97, 154
Redding Field Division	7, 55, 89, 135
San Francisco Field Division	21, 60, 97, 145
Division of Minerals and Statistics	43, 79, 111, 229
Estimate of 1922 output	43
Mineral production in 1922	229-232
Dolomite in Los Angeles County	165
Donkey Mine	8
Double Header Mine	11
Standard Mine	158
Drafting department	42, 78, 109, 228

	Page
Drag-line Scraper, Use of	141, 142
Dredging, San Francisco Field Division	21
Duralite Company, Inc.	100
Eagle Hydraulic Mine	10
Mine	22
Echo Group of Mines	158
El Dorado County:	
Activities in	141
Exploitation in	73
El Dorado Mine	11
Elephant Deep Hydraulic Mine	143
Group of Mines	159
Eliza Mine	11, 138
Emerson property, L. S.	63
Employment Service	52, 87, 133, 244
Positions wanted, list of	52, 87, 133, 245
Enterprise Mine	11
Estabrook Gold Dredging Company	9
Exploiting the Small Mine and Prospect, The problem of	72
Exposed Treasure and Desert Queen Mines	160
Exposed Treasure Mine	97
Fairchild Mine	58, 138
Faudre and Welsh Group	23
Featherstone Insulation Company	31
Features of 1922 oil production	33, 174
Files and mails	41, 78, 109, 228
First National Copper Company	8
Five Pines Mine	11
Flake Graphite Company	31
Florence G. Mine	23
Flotation tests with shale oil	222
Flow-sheet, N. T. U. Company, shale oil process	222
Ford Mine (see Apex Mine).	
Fortuna Mine	63
Foster Gold Mining Company	11
Franklin Mine	11
Fremont Mine	15, 143
Mining District	171
Peak Mine	172
Fresno County, Oil field operations in	65, 177, 181
Furlong-Poxon Pottery Company	94
Ganim Mine	11
Gardella gold dredges, Louis	9, 136
Garden City Pottery Company	94
General Petroleum Company	100
Gifford Mine	11
Gilta Mine	11
Gladding, McBean and Company	94
Gladstone Mine	11
Glenn Mine	18
Gold Ball Mine	11
Bank Hydraulic Mine	10
Bar Mines	93
Coin Group	162
Dredging	9
in Shasta County	9
in Trinity County	9
in Redding Field Division	9
Leaf Mine	11
Mining, San Francisco Field Division	21
Mountain property	30
Goldtown, Map showing	156
Golden Era Group (see Silver Basin Mine).	
Gate Mine	23
Goodyear, W. A., cited	145
Gore, F. D.	211
Grady and Sill property	61
Graham Bros. (see Catalina Island Quarry).	
Group (see Shasta Belmont).	
Granite, in Auburn Field Division	20
Graphite, 1922 statistics	115

	Page
Grass Valley Gold Mines, Consolidated.....	140
Gray Eagle Mine (see Echo Group of Mines).....	
Greenhorn Mine.....	8
Green Mountain Mine (see Crescent and Green Mountain).....	
Grey Eagle Mine.....	8
Haley, Chas. S.....	38
Hamilton, Fletcher, Resignation of.....	5
Hegler Mine (see Oregon Mine).....	
Hickey Homestead Hydraulic Mine.....	10
Highland Mine.....	11, 136
Hill, Jas. H.....	185
Hilltop-Nevada Mining Company.....	140
Hoboken Mine.....	11
Hoff Magnesite Company.....	26
Homer-Knowles Pottery Company.....	25
Homestake Mine.....	11
Honeycomb Mine.....	22
Hornet Mine (see Mountain Copper Company, Ltd.).....	
Hornets Nest Mine.....	22
Horse Mountain Copper deposits.....	91
Huey Hill Mine.....	10
Hydraulic Mining, in Redding Field Division.....	10
in Shasta County.....	10
in Siskiyou County.....	10
Idaho-Maryland group.....	73
Ida May Mine.....	11
Illinois Pacific Glass Company (see Amador Kaolin Company).....	
Imperial County, activities in.....	154
Gypsum Company.....	31
Independence Mine.....	11
Index group of mines.....	57
Industrial and structural minerals of Auburn Field Division.....	19
Infusorial and Diatomaceous Earth, in Shasta County.....	11
Statistics, 1922.....	116
International Magnesium Products Company (see Duralite Company, Inc.).....	
Ione-Carbondale District, Clay in.....	94
Coal in.....	96
Ione Firebrick Company.....	94, 96
Iron Mountain Investment Company.....	136
Mountain Mine.....	8
Ore in Shasta County.....	12
Italian-American Hydraulic Mine.....	139
Jacobs Hydraulic Mine.....	10
Jahdi Hydraulic Mine.....	10
Johannesburg Mining and Milling Company.....	61
Jonas Salstrom Mine.....	138
Jones Mine.....	142
Jumbo Placer Mine.....	142
June Bride Mine.....	11
Juniper Mine.....	10
Kane and Wilburn Group.....	92
Kangaroo Group.....	93
Karma Mine.....	161
Kaweah Lime Products Company.....	25
Molybdenum Mines Company.....	23
Keltz Mine.....	17
Kennedy Mine.....	15
Kern County, Amalle Mining District.....	156
Mining in.....	61, 97, 155
Mojave Mining District.....	156-164
Oil field operations in.....	36, 65, 101, 175, 177, 181
Keynote Mine.....	11
Keystone Mine.....	8
Kings County, Oil field operations in.....	178, 181
King Solomon Mine.....	30
Knoxville Mine.....	24
Kroromick Mining Company.....	22
Laboratory.....	45, 79, 127, 233
samples of possible commercial value, list of.....	45, 79, 127

	Page
Labor situation, Los Angeles Field Division	32
La Fortuna Mine	18
Mines Company	143
La Grange Gold Dredging Company	21
Hydraulic Mine	10
Laizure, C. McK.	21, 60, 97, 103, 145
Lamphyre Mine	18
Lange Bros. Hydraulic Mine	10
Lanky Bob Hydraulic Mine	10
Lassen County, Activities in	135
Layman Mine	11
Lead in Shasta County	12
Lewiston Gold Dredging Company	9, 59
Library	46, 81, 128, 234
Books received in	242
Current Magazines on file in	49, 84, 130, 242
Maps received in	49, 83, 242
Newspapers on file in	49, 84, 131, 243
Official publications received in	47, 81, 128, 234
Limestone, Auburn Field Division	20
deposits of McCloud River, Shasta County, and their possible value for cement material	69
in Shasta County	12, 69
List of laboratory samples of possible commercial value	45, 79, 127
Mineral products for sale	51, 86, 132
Mineral products wanted	51, 86, 132
Publications received in library	47, 81, 128
Lithia, 1922 statistics	118
Little Klondike Group	10
Nellie Mine	8
Wonder Mining Company	22
Livermore Pressed Brick Company	94, 96
Logan, C. A.	13, 59, 72, 94, 140
Lone Pine Mine	11
Star Mine	17
Long-Ryan Mine	26
Lorenz Bros. Hydraulic Mine	10, 139
Loring, Wm. J.	17, 75
Los Angeles County:	
Mining in	98, 164
Oil field operations in	36, 65, 101, 176, 178, 181
Los Angeles Field Division:	
Activities in	29, 61, 97, 154
Review of mining for 1922	29-33
Los Angeles Pressed Brick Company	94
Lost Horse Mine	11
Lucas Mine (see La Fortuna Mine).	
Mad Mule Mine	11
Magazines on file in library	49
Magnesite, Auburn Field Division	21
Statistics, 1922	119
Magnesium Materials Company	98
Mails and files	42, 78, 109, 228
Maloney prospect	144
Maltby, C. S.	26
Mammoth Mine	143
Mammoth Mine (Shasta County)	8
Smelter	8
Manganese in Redding Field Division	12
Maps received in library	49
Marble, Auburn Field Division	20
Mariposa Mine	22
McAtee Bar Mine	10
McCann Mine	18
McCloud River, Limestone deposits of, and their possible value for cement material	69
McGilvray-Raymond Granite Company	25
McKissick Cattle Company property	96
McLones Mine group (see Carson Hill Gold Mines, Inc.).	
Mendocino County, Coal in	145
Metallic Minerals, Los Angeles Field Division	30
Metal Mining in San Francisco Field Division	21
Metals Exploration Company	73

	Page
Mica, 1922 statistics.....	125
Milkmaid Mine	11
Mineral fertilizers (see Agricultural Minerals Act).	
Mineral production (see Statistics).	
in 1922	229-232
by counties	231
by substances	230
Mineral products or deposits, for sale, List of.....	51, 86, 132
wanted, List of	51, 86, 132
Minerals and Statistics, Division of.....	43, 79, 111, 229
Mining Engineers, District reports of.....	7, 55, 89, 135
Auburn Field Division.....	13, 59, 94, 140
Los Angeles Field Division.....	29, 61, 97, 154
Redding Field Division.....	7, 55, 89, 135
San Francisco Field Division.....	21, 60, 97, 145
Mining location on stock-raising lands.....	67
Public, To the	5
Minnie Haley Group of Mines.....	92
Mizpah-Mountain Mine.....	167
-Nevada Mine	168
Mojave Consolidated Gold Mines Company.....	160
Mining and Milling Company.....	158
Mining District	156-164
Geology	157
Mines of	158
Topography	156
Molybdenum, 1922 statistics.....	125
Monarch Mining Company.....	172
Mono Lake, Gold recovery plants.....	23
Mines Company	23
Monterey Bay Salt Company.....	60
County:	
Mining in	60
Oil field operations in.....	184
Moon King Leasing Company.....	61
Moore Mine	15
Mining Company	143
Morgan Mine Group (see Carson Hill Gold Mines, Inc.).	
Mother Lode Region, New report on.....	59
Mountain Copper Company, Ltd.....	8, 12, 136
Laurel Mine	11
Mount Ophir Mine.....	22
Shasta Silica Company.....	11, 136
Vernon Mine	11
Muddox Pottery Company.....	94
Mud Springs Mine.....	22
Museum	44, 79, 126, 232
Myrick property	63
National Cement Company.....	138
Kellastone Company	26
Natomas Company of California.....	21
Natural Soda Products Company.....	32
Nevada County:	
exploitation in	73
mining in	140
Nevada Wonder Mining Company.....	19, 74, 144
New Almaden Mine.....	24
district office	227
Idria Mines	24
Newman Clay Company.....	96
Newman, M. A.....	29, 61, 97
New Publications	41, 77, 108, 227
Report on Mother Lode Region.....	59
Tonopah Dividend Mining Company.....	162
Newspapers on file in library.....	49
Nickel, 1922 statistics.....	126
Noble Electric Steel Company.....	12
Noce Mine	18
Nonmetallic Minerals, Los Angeles Field Division.....	31
Nonmetals, San Francisco Field Division.....	24
North Star Mines.....	140
costs at	140

	Page
Norton, R. R., and Jas. S. Brogan, Asbestos deposit of.....	26
Notes on Peat and its occurrence in California.....	103
N. T. U. Company, Flow sheet of.....	222
shale oil plant.....	219
Nugget Bar Mine.....	10
Bar Placers Company.....	10, 140
Gold Mining Company.....	171
Nyman Consolidated Mine (see Santa Ysabel Mine).	
Oak Bottom Placer Syndicate.....	10, 139
Oakland Art Pottery Company.....	94
Official publications received in library, List of.....	47, 81, 128
Oil (see also petroleum).	
Field Development Operations.....	33, 65, 101, 174
Features of 1922 production.....	33, 174
Fresno County.....	65, 177, 181
Kern County.....	36, 65, 101, 175, 177, 181
Kings County.....	178, 181
Los Angeles County.....	36, 65, 101, 176, 178, 181
Monterey County.....	184
Orange County.....	37, 66, 102, 177, 180, 184
Riverside County.....	102, 177, 184
Sacramento County.....	184
San Bernardino County.....	37, 66
San Diego County.....	102, 177
San Joaquin County.....	184
San Mateo County.....	177, 180, 184
Santa Barbara County.....	102, 177
Santa Clara County.....	180
Santa Cruz County.....	66
Sonoma County.....	37, 102, 180, 184
Stanislaus County.....	66, 184
Tulare County.....	66, 102, 180
Ventura County.....	37, 66, 102, 177, 180, 184
Yolo County.....	180
Sands, Mining of.....	32
Shale, Comparison of California shale to other states.....	212
Companies operating.....	216
Flotation tests.....	222
Future possibilities.....	224
Geological conditions governing the deposits.....	215
in Santa Barbara County, California.....	211-224
Omega Mine.....	19, 145
Ophir Mine.....	173
Orange County:	
Mining in.....	165
Oil Field Operations in.....	37, 66, 102, 177, 180, 184
Oregon Mine.....	138
Original Mining and Milling Company.....	22
Oro Grande District.....	173
Osgood Mine.....	138
Otalite in San Diego County.....	100
Pacific Clay Products Company.....	32
Coast Borax Company.....	31
Pottery and Terra Cotta Company.....	94
Gold Dredging Company.....	9
Limestone Products Company.....	25
Marble Quarries Company.....	64
Porcelain Ware Company.....	94
Sanitary Manufacturing Company.....	25
Packer Mine.....	11
Paddy Cronin Hydraulic Mine.....	10
Patriquin Bros.	24
Patterson Mine.....	74
Peacock Gold Placer Mining Company.....	138
Peat.....	27
and its occurrence in California, Notes on.....	103
Peckham, S. F., cited.....	147
Pennywell & Company.....	25
Personnel, Changes in.....	110
Petroleum in Redding Field Division.....	12
Philadelphia Exploration Company.....	73
Quartz Company.....	96

	Page
Pittsburg and Mount Shasta Mining and Milling Company.....	8, 62, 166
-Comstock Mining Company.....	10, 59, 139
-Liberty Mine.....	23
Placer County:	
Activities in.....	140
Exploitation in.....	73
Platinum in Redding Field Division.....	12
Plumas County, Exploitation in.....	73
Plymouth Consolidated Mine.....	16
Portuguese Bar Mine.....	10
Positions wanted, List of.....	52, 87, 133
Poso Mine.....	155
Precious Twins Placer Mine.....	94
Preface.....	3
Primary and Secondary Gold Concentrations.....	38
Princeton Mine.....	22
Problem of exploiting the small mine and prospect, The.....	72
Producers and consumers.....	51, 86, 132, 244
Mining in California.....	244
Products or deposits for sale.....	51, 86, 132
Products or deposits wanted.....	51, 86, 132
Production, Mineral (see Statistics; also under each substance head).	
Publications:	
Distribution of.....	41, 77
List of official, received in library.....	47, 81, 234
New.....	41, 77, 227
Pyrite in Redding Field Division.....	12
Quail Mine.....	22
Quartz (see Sand and Quartz).	
Hill Hydraulic Mine.....	10
Quartz Mining.....	10
in Lassen County.....	10
in Modoc County.....	10
in Shasta County.....	11
in Siskiyou County.....	11
in Trinity County.....	11
Queen Esther Mine.....	162
Quicksilver in Redding Field Division.....	12
New use for.....	29
Rainbow Group.....	93
Mine.....	58
Ramelli Dolomite Deposit.....	165
Rand Consolidated Silver Mining Company.....	62
Contact Mine.....	168
District.....	30, 61, 165
Randsburg Silver Mining Company.....	31, 61
Rattlesnake Hydraulic Mine.....	10
Raymond Granite Company.....	25
Raymond, R. W., cited.....	146
Rebel Mine.....	94
Redding Field Division.....	7, 55, 89, 135
Review of mining during 1922.....	7-13
Red Hill Gravel Mine.....	144
Hydraulic Mine.....	10
Mine.....	18
Reid Mine.....	11
Reiner Mine (see Victor Land and Mineral Company).	
Rentschler Mines Company.....	173
Reports of District Engineers.....	7, 55, 89, 135
Auburn Field Division.....	13, 59, 94, 140
Los Angeles Field Division.....	29, 61, 97, 154
Redding Field Division.....	7, 55, 89, 135
Sacramento Field Division.....	140
San Francisco Field Division.....	21, 60, 97, 145
Resignation of Fletcher Hamilton.....	5
Review of Mining during 1922:	
Auburn Field Division.....	13-21
Los Angeles Field Division.....	29-33
Redding Field Division.....	7-13
San Francisco Field Division.....	21-29

	Page
Richmond Pressed Brick Company.....	94
Rights of locator on stock-raising lands.....	67
Rising Star Mine (see Shasta Zinc and Copper Company).....	
Sun Mine.....	74
Riverside County, Oil field operations in.....	102, 177, 184
Portland Cement Company.....	24
Robinson Hydraulic Mine.....	10
Rocky Mt. George.....	28
Root, Lloyd L.....	53
Ruby Pearl Mine.....	11
Ruth Pierce Mine.....	22
Sacramento County, Oil field operations in.....	184
Salt from Monterey Bay Salt Company, Analysis of.....	60
Sam Laird Ranch.....	140
Samples submitted of possible commercial value, List of.....	45, 79
Sampson Magnesite Company.....	26
San Benito Coal Mining Company.....	27
San Bernardino County:	
Fremont District.....	171
Mining in.....	61, 63, 98, 165
Oil field operations in.....	37, 66
Oro Grande District.....	173
Randsburg District.....	165
Sanborn, Frank.....	45, 79, 127, 233
Sand and Quartz, Auburn Field Division.....	20
San Diego County:	
Mining in.....	100
Oil field operations in.....	102, 177
San Domingo Quartz Mine.....	22
San Francisco Field Division.....	21, 60, 97, 145
Coal in Mendocino County.....	145-154
Review of activities in 1922 with notes on the outlook for 1923.....	21-29
San Joaquin County, Oil field operations in.....	184
San Mateo County, Oil field operations in.....	177, 180, 184
San Barbara County:	
Oil field operations in.....	102, 177
Oil shale in.....	211-224
Santa Clara County, Oil field operations in.....	180
Santa Cruz County, Oil field operations in.....	66
Secretary's office.....	41, 77, 108
Shadows Creek Mine.....	10
Shale from Shasta County, Analysis of.....	71
Shale in Santa Barbara County, Oil.....	211-224
Shasta-Belmont Group.....	92
Shasta County:	
Activities in.....	11, 55, 89, 135
Copper mining in.....	55, 89
Gold mining in.....	57, 93
Limestone deposits of McCloud River, and their possible value for cement material.....	69
Quartz mining in.....	11
Shasta Dredging Company.....	9
Hills Mining Company.....	11
Iron Company.....	12
May Blossom Mine.....	91
Mining Company.....	137
Zinc and Copper Company.....	8, 13
Sheep Ranch Mine.....	17
Sierra County, Exploitation in.....	73
Magnesite Company.....	26
Silverado Mine.....	23, 165
Silver Basin Mine.....	169
Mining Company.....	63
Silver Belle Mine.....	169
Dome Mine.....	172
Falls and Chicago Consolidated Mines.....	136
Glance Mine.....	169
in Redding Field Division.....	13
King Group.....	62, 169
Lead Mine.....	22
Moon Group.....	62
Simpson Mining Company.....	22

	Page
Siskiyou County:	
Activities in	11, 58, 93, 138
Placer Mining in	58
Quartz Mining in	11, 58, 93
Slate, Auburn Field Division	20
Sliger Mine	143
Small mine and prospect, Problem of exploiting the	72
Smith Mine	64
Snow Gulch Hydraulic Mine	10
Soapstone, Auburn Field Division	21
Sonoma County, Oil field operations in	37, 102, 180, 184
Sonora Wonder Mine	145
South Rand Mine	169
Souza Ranch property	93
S. P. Brick Company	25
Special Articles:	
Agricultural Minerals Act	225-226
Clay Deposits of the Alberhill Coal and Clay Company	185-210
Limestone deposits of McCloud River, Shasta County, and their possible value for cement material	69-71
Mining location on stock-raising lands	67-68
Notes on Peat and its occurrence in California	103-107
Oil Shale in Santa Barbara County, California	211-224
Primary and secondary gold concentrations	38-40
Problem of exploiting the small mine and prospect	72-76
Spring Flag Mine	11
Standard Consolidated Gold Mining Company	97
Mine	23
Mining and Milling Company	160
Stanislaus County, Oil field operations in	66, 184
Statistics	43, 79, 111, 229
Estimate of 1922 output	43
Mineral production in 1922	229-232
Stayton Mining Company	22
Sterling Borax Company	31
St. Gabriel Mine	22
St. John Mine	24, 140
St. Lawrence Rand Mine	170
St. Mary Mining Company	162
Stock-raising lands, Mining location on	67
Stockton Fire and Enamel Brick Company	94
Stone Canyon Coal Mine	26
Strode Mine	11
Structural and industrial minerals of Auburn Field Division	19
Success Mine	23
Sulphur Springs Mine	10
Summit Mine	11
Sunshine Mine	10
Sutro Mine	8
Sybil Mine	11, 137
Tecopa Consolidated Mines Company	30
Tehama County, Mining activities in	93
Texas Consolidated Mine	11, 58, 137
Hill Mining Company	22
Thayer, W. W.	41, 77
Thomas Mine (see Camp Carbon Coal Mine).	
Tonopah Mining Company	19, 74, 145
To the Mining Public	5-53
Treasure Hill Mine	170
Mine	16
Trinity Bonanza King Mine	11
Consolidated Hydraulic Mining Company	58
Gold Dredging Company	9
Trinity County:	
Activities in	58, 94, 139
Quartz mining in	11
Triple Lode Mine	18
Triumvate Mining Company	56
Tropico Mines	30, 155
Tucker, W. Burling	7, 55, 69, 89, 135, 154
Tulare County, Oil field operations in	66, 102, 180
Tunnel Hill Ochre Deposit	143

	Page
Tuolumne County:	
Exploitation in	74
Mining in	19, 144
Tuscan Oil Company	12, 93
Uncle Sam Mine	56
Underground Treasure Mine	10
Union Hill Hydraulic Mine	58
Unit plan of mine exploitation	75
United Mines Company	159
Mines, Inc.	171
Unity Hydraulic Mine	10, 140
U. S. Bureau of Mines, cited	67
Gypsum Company	31
Smelting, Refining and Mining Company	8, 57
Utica Mining Company	17
Valdor dredge	9
Venicia Mine	11
Ventura County, Oil field operations in	37, 66, 102, 177, 180, 184
Victor Land and Mineral Company	18
Victory Gold Mining Company	139
Hydraulic Mine	10
Virginia Belmont Mine	22
Visalia Masonic Mining Company	23
Wait Marble deposit	143
Warner Barnes & Co.	23
Washington Mine	11
West Coast Porcelain Company	25, 94
End Chemical Company	32
End Mine	11
Western Magnesite Development Company	26
Mercury Company	24
Silica Company	61
Wetzel Hydraulic Mine	10
White Horse Mine	171
Oak Mine	22
Rock Land and Mineral Company (see Jumbo Placer Mine).	
Rock Mine	26
Star Mine	12, 13
Whitmore Mine	162
Wideawake Mine	24
Woodrow Wilson Mine	56
Yankee Hill Gold Mining Company	22
John Mine	11
Yellow Aster Mine	30
Dog Extension Mine	164
Dog Mine	30, 98, 163
Yolo County, Oil field operations in	180
Yosemite Dredging and Mining Company	21
Zenda Mine	156
Mining Company	30
Zinc in Redding Field Division	13

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-three years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield, and Sacramento. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining Bureau.

REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks -----	-----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks-----	-----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks-----	-----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks-----	-----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks-----	-----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. By Henry G. Hanks-----	-----
**Part II, 1887, 222 pp., 36 illustrations. William Ireland, Jr.-----	-----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Ireland, Jr. -----	-----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Ireland, Jr.-----	-----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Ireland, Jr.-----	-----
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Ireland, Jr.-----	-----
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Ireland, Jr.-----	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford-----	-----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford -----	-----
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton :	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper-----	-----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper-----	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper-----	.25
Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pp., paper-----	.50
Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper-----	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper-----	-----
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915 :	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth -----	2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton :	
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper -----	.65
Same, including geological map of Inyo County-----	1.25
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper-----	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper-----	.65

REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties, 136 pp., paper -----	\$0.50
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper -----	.65
Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper -----	.65
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–1916, Fletcher Hamilton, 1917:	
A general Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth -----	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917–1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper -----	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper -----	.50
Mines and Mineral Resources of Sierra County, 144 pp., paper -----	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California During 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth -----	1.75
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922 -----	Free
Nineteenth Report of the State Mineralogist, 1923, Mining in California, Fletcher Hamilton; Lloyd L. Root. Chapters published monthly January to March, 1923, quarterly beginning with September, 1923.	
January, February, March, 1923 -----	Free
September -----	Free
Nineteenth Report of the State Mineralogist, Mining in California, Fletcher Hamilton and Floyd L. Root, January, February, March, September --	Free
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) -----	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, **December, 1919 -----	Free
January, February, March, April, **May, June, July, **August, September, October, November, December, 1920 -----	Free
**January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921 -----	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922 -----	Free
January, February, March, April, May, June, July, 1923 -----	Free
January, February, March, April, May, 1923 -----	Free

BULLETINS.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations -----	---
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations -----	---
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. -----	---
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) -----	---
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations -----	---

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations-----	\$0.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations-----	----
**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.-----	----
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations-----	----
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 13. Mineral Production of California, by Counties for 1897, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale-----	----
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899-----	----
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations-----	----
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations-----	----
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps-----	----
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899-----	----
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet-----	----
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet-----	----
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps-----	50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps-----	----
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet-----	----
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps-----	----
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet-----	----
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp.-----	----
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet-----	----
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps-----	----
**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet-----	----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California-----	----
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps-----	----
Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kuntz. 1905, 168 pp., 54 illustrations-----	\$0.25
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map-----	----
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet-----	----
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps-----	----
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps-----	----
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp.-----	----
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp.-----	.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet-----	----
**Bulletin No. 48. Mineral Production of California for Twenty Years. 1906, by Charles G. Yale-----	----
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp.-----	----
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)-----	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet-----	----
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet-----	----
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp.-----	----
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet-----	----
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet-----	----
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp.-----	----
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps-----	----
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet-----	----
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet-----	----
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp.-----	----
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet-----	----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet-----	----
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps-----	----
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp.---	----
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp.---	----

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp.-----	-----
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp.-----	-----
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp.-----	-----
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]-----	-----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp.-----	-----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations.-----	-----
Bulletin No. 72. The Geologic Formations of California, with Reconnaissance Geologic Map, by James Perrin Smith. 1916, 47 pp.-----	\$0.25
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin. 278 pp., 26 illustrations.-----	-----
Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations.-----	Free
**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp., paper-----	-----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring. 1918. 248 pp., 51 illustrations, 5 maps, paper-----	.50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880-1917, by E. S. Boalich. 44 pp., paper-----	Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth-----	1.50
Bulletin No. 79. Magnesite in California. (Unpublished.)-----	-----
Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)-----	-----
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)-----	-----
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp., 31 illustrations, cloth-----	-----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper-----	Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth-----	-----
Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper-----	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper-----	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper-----	-----
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper-----	Free
Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leek, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth-----	1.25
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paper-----	Free
Bulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp., cloth-----	1.00
Bulletin No. 93. California Mineral Production for 1922, by Walter G. Bradley, 1923-----	Free

PRELIMINARY REPORTS.

Asterisks (**) indicate the publication is out of print.

	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp.-----	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp.-----	----
**Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp.-----	----
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper.-----	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper.-----	Free
Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper.-----	Free
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper.-----	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper.-----	----

MISCELLANEOUS PUBLICATIONS.

Asterisks (**) indicate the publication is out of print.

**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp.-----	----
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp.-----	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.-----	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp.-----	----
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp.-----	----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp.-----	----
**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894.-----	----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper.-----	----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper.-----	Free
Commercial Mineral Notes. A monthly mimeographed sheet. April, May, June, July, August, September, 1923.-----	Free

MAPS.

Registers of Mines With Maps.

Asterisks (**) indicate out of print.

	Price
Register of Mines, with Map, Amador County -----	\$0.25
Register of Mines, with Map, Butte County -----	.25
**Register of Mines, with Map, Calaveras County -----	----
**Register of Mines, with Map, El Dorado County -----	----
**Register of Mines, with Map, Inyo County -----	----
**Register of Mines, with Map, Kern County -----	----
**Register of Mines, with Map, Lake County -----	----
**Register of Mines, with Map, Mariposa County -----	----
**Register of Mines, with Map, Nevada County -----	----
**Register of Mines, with Map, Placer County -----	----
**Register of Mines, with Map, Plumas County -----	----
**Register of Mines, with Map, San Bernardino County -----	----
**Register of Mines, with Map, San Diego County -----	----
Register of Mines, with Map, Santa Barbara County -----	.25
**Register of Mines, with Map, Shasta County -----	----
**Register of Mines, with Map, Sierra County -----	----
**Register of Mines, with Map, Siskiyou County -----	----
**Register of Mines, with Map, Trinity County -----	----
**Register of Mines, with Map, Tuolumne County -----	----
Register of Mines, with Map, Yuba County -----	.25
Register of Oil Wells, with Map, Los Angeles City -----	----

OTHER MAPS.

Asterisks (**) indicate the publication is out of print.

Map of California, Showing Mineral Deposits (50 x 60 in.)—	
**Mounted -----	----
**Unmounted -----	----
Map of Forest Reserves in California—	
Mounted -----	.50
**Unmounted -----	----
**Mineral and Relief Map of California -----	----
**Map of El Dorado County, Showing Boundaries, National Forests -----	----
**Map of Madera County, Showing Boundaries, National Forests -----	----
**Map of Placer County, Showing Boundaries, National Forests -----	----
**Map of Shasta County, Showing Boundaries, National Forests -----	----
**Map of Sierra County, Showing Boundaries, National Forests -----	----
**Map of Siskiyou County, Showing Boundaries, National Forests -----	----
**Map of Tuolumne County, Showing Boundaries, National Forests -----	----
**Map of Mother Lode Region -----	----
**Map of Desert Region of Southern California -----	----
Map of Minaret District, Madera County -----	.20
Map of Copper Deposits in California -----	.05
**Map of Calaveras County -----	----
Map of Plumas County -----	.25
**Map of Trinity County -----	----
Map of Tuolumne County -----	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles -----	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin -----	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted -----	2.50

OIL FIELD MAPS.

These maps are revised from time to time as development work advances and ownerships change.

	Price
Map No. 1—Sargent, Santa Clara County-----	\$0.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos-----	.75
Map No. 3—Santa Maria, including Casmalia and Lompoc-----	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente Hills, East Coyote and Richfield-----	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello-----	.75
Map No. 6—Salt Lake, Los Angeles County-----	.75
Map No. 7—Sunset and San Emido and Kern County-----	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County-----	.75
Map No. 9—North Midway and McKittrick, Kern County-----	.75
Map No. 10—Belridge and McKittrick, Kern County-----	.75
Map No. 11—Lost Hills and North Belridge, Kern County-----	.75
Map No. 12—Devils Den, Kern County-----	.75
Map No. 13—Kern River, Kern County-----	.75
Map No. 14—Coalinga, Fresno County-----	.75
Map No. 15—Elk Hills, Kern County-----	.75
Map No. 16—Ventura-Ojai, Ventura County-----	.75
Map No. 17—Santa Paula-Sespe Oil Fields, Ventura County-----	.75
Map No. 18—Piru-Simi-Newhall Oil Fields-----	.75
Map No. 19—Arroyo Grande, San Luis Obispo County-----	.75
Map No. 20—Long Beach Oil Field-----	1.00
Map No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern and Kings counties-----	.75
Map No. 22—Portion of District 3, Showing Oil Fields, Santa Barbara County-----	.75
Map No. 23—Portion of District 2, Showing Boundaries of Oil Fields, Ventura County-----	.75
Map No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los Angeles and Orange counties-----	.75
Map No. 25—Kern River Oil Field-----	.75
Map No. 26—Huntington Beach Oil Field-----	.75
Map No. 27—Santa Fe Springs Oil Field-----	.75
Map No. 28—Torrance, Los Angeles County-----	.75

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

THE STATE MINING BUREAU
CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALI- FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, is also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily.

Saturday, 9 a.m. to 12 m.

LLOYD L. ROOT,

State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.
Branch Offices: Pacific Finance Building, Los
Angeles; Sacramento, Bakersfield, Taft, Coal-
inga, Santa Maria, and Santa Paula.

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

AN INITIAL FINE OF 25 CENTS

WILL BE ASSESSED FOR FAILURE TO RETURN
THIS BOOK ON THE DATE DUE. THE PENALTY
WILL INCREASE TO 50 CENTS ON THE FOURTH
DAY AND TO \$1.00 ON THE SEVENTH DAY
OVERDUE.

JUN 30 1982
RECEIVED

JUN 8 1980

PHYS SCI LIBRARY

JAN 6 1982

RECEIVED

NOV 25 1981

PHYS SCI LIBRARY

DEC 23 1991

renewed to
Jan. 9, 1992
Jan. 24, 1992
Feb. 10, 1992

FEB 01 1992

PHYS SCI LIBRARY



3 1175 00485 9453

Calif.

QE89

A1

C3

v. 19

1923

108698

